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REPORT NUMBER

LAND MANAGEMENT INFORMATION IN

NORTHWEST MINNESOTA

The beginning of a statewide system

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The Beginning of a Statewide System

Report Number One
Minnesota Land Management Information System Study,
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INTRODUCTION

This report describes a project aimed at building a storehouse of basic information on land use in Minnesota, and combining it with other data on subjects such as natural resources, population, and state-local government finances. The report describes an initial attempt at developing the framework of an integrated information system — the Minnesota Land Management Information System (MLMIS). The potential use of the system is demonstrated in this report by construction of a pilot data system for Development Region 1 in northwestern Minnesota.

This pilot system includes data on the use, types, value, and ownership of the land in Region 1; population; pattern of resources development and changes settlement has brought to the landscape.

An integrated statewide data system is not, however, an end in itself. The fundamental goal of the MLMIS project is not to accumulate information, but rather to improve the quality of public and private decisions affecting the environment. Initially this is being done by:

- Examining and revising present techniques of collecting and storing data relating to land use in an attempt to establish standards for a statewide data system.
- Promoting long-term cooperation and coordination among researchers and public officials.

Among the MLMIS study recommendations for improving the collection, storage, management, and use of public data are:

- Coordinated updating of public records, using standardized data, should continue
- The state should issue prescribed reporting practices so that information is collected and stored in a standard way by all units of state government
- Variables should be described objectively, not subjectively, in order to assure uniformity
- A statewide land-use census should be taken at least every decade
- State land-ownership records should be centralized and put in a form that makes analysis of the information possible. Periodic inventories of this land should be published by the Department of Administration, as required by statute
- A cooperative program to exchange land-ownership information between the state and counties, and the state and federal government, should be instituted
- The use and location of municipally-owned land in Minnesota should be inventoried
- A comprehensive information system should be created on Minnesota's water resource by combining various water records already being kept and adding additional information not now collected
- Standard identifiers (indexes or numbering systems) should be created for all lakes, streams and other water sources in Minnesota
- Lake information should be combined in a central file available for all state agencies to use
- Similarly, a single stream-information system should be created and available for all state uses
- Ground water sources should be inventoried in a coordinated manner

Chapter I

THE MINNESOTA LAND MANAGEMENT INFORMATION SYSTEM STUDY

The primary goal of the Minnesota Land Management Information System (MLMIS) project is to improve the quality of public- and private-sector decisions about the environment. MLMIS is doing this by providing extensive information, previously unavailable, on present land use and economic and social conditions.

The project is achieving its goal in two ways:

Examining and revising present data collection and storage techniques relating to land use in an attempt to establish standards to be utilized in a statewide data system. This means combining in compatible computer systems a broad range of data now collected routinely and maintained separately by government agencies in their regular licensing, regulating, and management functions. These data have not been readily available for use by agencies other than the collecting agency, partly because most of the data has not been collected, stored, or coded in a compatible way. What has been missing is a framework (an information transfer point common to all agencies) in which to put all the data, so that it could be easily retrieved and summarized for use in planning and in helping to answer broad policy questions. Groundwork done by the study can assist in formulating standards for establishing structured data collection and storage techniques.

Promoting long-term cooperation and coordination among researchers and public officials. This is being done to ensure that the standardized information is of value to both groups and will be utilized by public officials as they manage Minnesota's resources. This objective is being met in three ways:

1. The MLMIS study group is undertaking interdisciplinary research projects within the University of Minnesota and joint University-state agency research projects. All the research projects are coordinated through the Center for Urban and Regional Affairs at the University. A list of these projects and their participants follows:

Land Use Map of Minnesota Assembling a storehouse of land data to be used in producing a state land use map. This map displays the use of all land in Minnesota.	State Planning Agency, Upper Great Lakes Regional Commission
Empire Township Study The study used 10-acre cells and tested the feasibility of using MLMIS to make urban land use decisions.	Landscape Architecture, University of Minnesota
Mineral Pilot Study The goal is to investigate the feasibility of centralizing descriptive geologic information and mineral ownership records.	Minnesota Land Exchange Review Board, Minnesota Department of Natural Resources, Division of Waters, Soils and Minerals
Computerization of Brainerd Soils Sheet The Soils Department is investigating the value of correlating soil types with general land-use information by coding soils data with the MLMIS information.	Soils Department, University of Minnesota, Minnesota Resources Commission
Federal Recreation Areas Impact Study This study is testing the feasibility of using the study data as a tool to analyze the impact of major federal recreation areas on land surrounding them.	University of Wisconsin, Upper Great Lakes Regional Commission

Master Plans for Components of the State Outdoor Recreation System

This study will attempt to build techniques that can automate much of the master planning work needed for development of state outdoor recreational facilities.

State Planning Agency, Department of Natural Resources, Landscape Architecture, University of Minnesota

2. Encouraging public officials to use new techniques such as computer mapping that have been developed by MLMIS researchers. Four state agencies are currently utilizing these computer techniques.[1] This is fostered by having MLMIS researchers work part time with these agencies.

3. Encouraging the cooperation of state agencies in keeping resource data current and in adding new data to the existing computerized collection.

Efforts now are being made to standardize and keep up to date all state land-ownership records, as well as information on Minnesota lakes.

With the study's major objectives in mind, the MLMIS project has begun the basic construction of a statewide data system.

The project is not attempting to create such a system for the whole state at once. Instead, a pilot sub-system containing land and some related information was constructed for just one of Minnesota's 11 development regions. The other studies being conducted by the study group are being undertaken to refine methods for expanding this pilot system.

The remainder of this report describes this pilot system design and, using the pilot system, summarizes the land resource development pattern of Development Region 1.

For the pilot region, the MLMIS study group brought together information from a variety of separate data sources — the federal census, state and federal agencies, county governments, and research studies. The combined information was used to produce both a general description of the entire development region and a number of special studies which are contained in this report. They are not meant to be exclusive, unrelated works. Rather, they illustrate how data on land use and economic and social factors — once assembled and made compatible — can be used to describe the pattern of resource development in an area and to aid decision-makers in a more comprehensive way than would otherwise be possible.

The bulk of this report was compiled by using separately the various independent data sources. But as information from these sources was processed, much of it was given a common code and combined in a common computer file. This information is now stored under the same heading and written in the same language. In other cases, the separate data sources were cross-referenced to the MLMIS information.

History of the MLMIS Study

The concept of bringing different data systems together, along with some additional data collection, is primarily a result of prior studies dealing with Minnesota's lakeshore and a State Planning Agency report on State land holdings.[2] The initial study was conducted in the Recreation Project at the U.S. Forest Service's North Central Forest Experiment Station.[3] It dealt with lakeshore development in the Brainerd area of Crow Wing County. That study was used as a blueprint for a second project, the Minnesota Lakeshore Development Study conducted in the Department of Geography at the University and financed by the Minnesota Resources Commission.[4]

[1] Projects have been carried out with: Department of Natural Resources, State Planning Agency, Minnesota Highway Department and Department of Administration.

[2] *A State Land Inventory,* Minnesota State Planning Agency, November, 1968.

[3] George W. Orning, "The Process of Lakeshore Development in Crow Wing County," Unpublished M.A. Thesis, Department of Geography, University of Minnesota, 1967.

[4] John R. Borchert, George W. Orning, Les Maki and Joseph Stinchfield, *Minnesota's Lakeshore,* Part I (Resources, Development, Policy Needs) and Part II (Statistical Summary), Minneapolis, University of Minnesota, Center for Urban and Regional Affairs, 1970.

To conduct these earlier studies, researchers found it necessary to: 1) collect data from a variety of different sources; 2) make the information from each source compatible by use of a common data cell, or geographic unit; and 3) integrate the information. The data cell selected was the smallest consistent unit of the federal township and range land-survey system — the 40-acre parcel. This parcel size and description is the lowest common denominator of most public records dealing with land. Most blocks of land, whether publicly or privately owned, have these lines, or segments of them, as boundaries. The majority of Minnesota's roads run along these lines. The lines are reflected in agricultural areas as field lines, in forested areas as timber-cutting boundaries, and in urban areas as city blocks. They help to describe the manner in which people have divided the land and shaped the landscape of Minnesota.

Design of the MLMIS Study

The MLMIS project uses the same geographic unit as the earlier studies — the 40-acre parcel (forty) — as its basic building block for data collection (Figure One — Diagram of the Land Survey). For each forty, the following information was collected and combined, in a standard code, on one punch card (Figure Two — Design and Data Sources of the MLMIS Study).

(1) *Location* — county, township and range; section and 40-acre parcel location; government lot number; latitude and longitude; minor civil division (township, village, city, etc.).

(2) *Contiguity to lakes or watercourses* — whether bordered by, or containing, lakes, rivers and streams.

(3) *Land use* — use to which the land is devoted, based on the following classifications:

forested	urban non-residential or mixed residential
cultivated	open and pasture
water	extractive
marsh	transportation
urban residential	

(4) *Ownership* — private or public and, if public, the managing agency.

Once the above information was assembled and entered in standard form on punch cards (each representing one forty), the cards could be combined in many different ways. The different combinations of cards, when fed into a computer, can quickly produce various summaries of the information they contain — the cultivated land in a given township, for example, or the state-owned forested land adjoining water in a given county. The various groupings of data cards are called "card files." When this information is transferred to magnetic tapes for more rapid computer use, it is called a "tape file."

MLMIS chose for this report to create four temporary tape files, using integrated information and grouping it into new categories (Figure Two). Two files were created for government administrative areas: a Township File and a Minor Civil Division File. From the minor civil division file two additional files were created: a watershed file and a wood-processing plant location file.

In addition, MLMIS developed a compatible coding system to link its tape files to other files which contain added information not entered on the MLMIS punch cards. In this way, the data from other agencies — the U.S. Census, State-Federal Crop and Livestock Reporting Service, and the Rapid Analysis Fiscal Tool (RAFT)[5] study — was compared with the MLMIS information in the minor civil division file. Also, information on original vegetation was merged with the township file (Figure Two). These mergers were possible because common identifiers existed on each of the separate agency files.

This merger of information means that a great deal more data can be summarized and interrelated, and that it can be assembled in various combinations — county, municipality, etc. The population, age, income and housing conditions in a given township can, for example, be examined in light of the land-use, lake characteristics, type of crops and amount of production in that township. The diagram illustrates that data has been contributed from government sources (state, federal and county) and from departments at the University of Minnesota.

[5] This study, originated by the Upper Midwest Research and Development Council and Citizens League, is bringing together and computerizing large amounts of local government fiscal information and developing a set of programs that will enable legislators and other decision-makers to simulate the results of changes in the state-local tax system.

The two principal reasons for creating these new data files are:

- First, much of the information available is collected only for units larger than 40-acre tracts. For example, the smallest unit by which the U.S. Census Bureau lists population information in rural areas is the Minor Civil Division, usually a township. But MLMIS land-use information is compiled by 40-acre parcels, which are much smaller units. Therefore, in order to compare the population and land-use in a given municipality, the land-use information on each 40-acre parcel within that municipality must be aggregated.
- Second, the files can be combined to form special regional files. When the Department of Natural Resources conducts a watershed study, for example, it must study, among other things, the land-use and population distribution in the watershed, and determine the local government jurisdictions and state or federal management units within that watershed. Minor civil division files containing the land use, ownership and population within that watershed can be combined into a new file representing the watershed. This new file would be a special watershed file, providing a data base for a portion of the watershed study. MLMIS has illustrated the feasibility of such an approach with a watershed case study in Chapter 5.

With standardized, objective resource data available, it will be feasible to build a system that makes possible the retrieval of information on a problem from standardized data files of several different agencies. If, for example, a pipeline is to be built through a portion of the state, much of the impact along many alternate routes can be investigated rapidly and efficiently.

In addition to the four files used in this report, other files such as county or regional planning files can be created. Also, by linking data files to other records, much additional information can be made accessible for each Forty, Township, Minor Civil Division or County. At present, MLMIS is making one additional data source, the Lakeshore Development Study, compatible with its system.[6] Eventually, other agencies with geographically keyed data will be encouraged to merge with MLMIS.

The remainder of this report concerns itself with the use of the data files described above. Using the information system's Minor Civil Division file, population and settlement features of the pilot study area — Development Region 1 — will be described. In addition, three case studies, using the other three files, have been carried out on portions of that region. They cover man's alteration of the virgin landscape, a watershed case study, and a wood processing plant location study.

This data system should be considered as only the outline, or beginning, of a comprehensive, integrated data system that managers and researchers can use to help solve problems, set priorities and define programs. Such a system is never complete; it should change constantly as new data becomes available and as technology and management personnel change. If this is to occur, potential users must now and in the future participate actively in development of the system, in order to ensure that the system satisfies their needs. It is hoped, then, that potential users will become familiar with MLMIS and freely offer suggestions in the present, early stage of system development.

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[6] The Lakeshore Study contains extensive information collected for the forties or government lots surrounding Minnesota's lakes. For most of the state's lakeshore, the study includes the number of dwellings, the physical characteristics of the shore, and highway accessibility.

DESIGN AND DATA SOURCES OF THE MINNESOTA LA

Locational Information

The *township* is a survey block six miles on a side, composed of 36 one mile square units, or sections, of 640 acres.
The *section* is divided into four 160-acre quarter-sections. These quarter-sections are further subdivided into 40-acre parcels. The *forty* is the smallest unit of the general land survey (if not exactly 40 acres, the parcel is called a *government lot*). The forty is the basic building block of the MLMIS study.

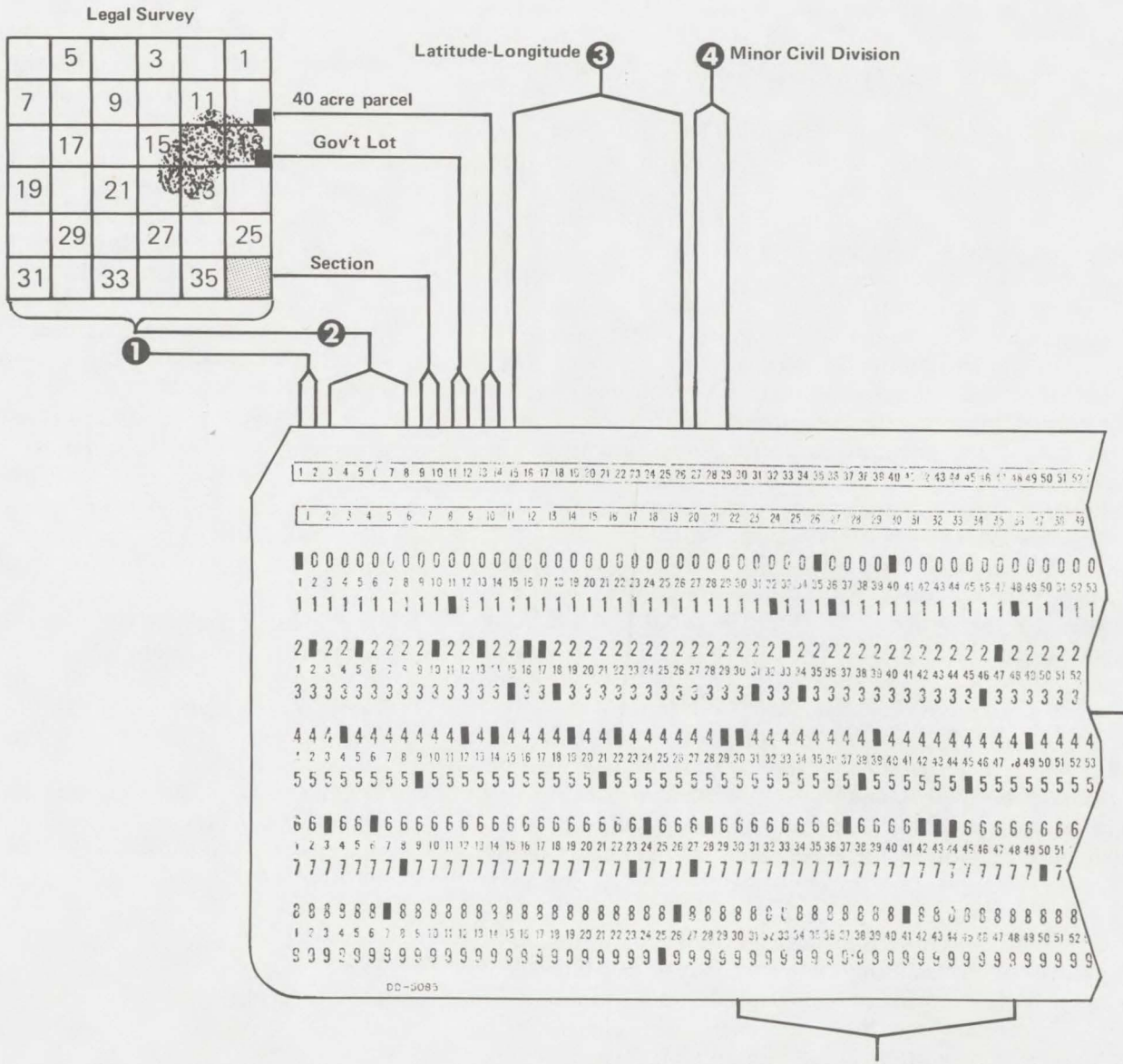
There are four different types of locational information.

❶ County Identification
Each county is assigned a number according to alphabetical order ranging from 1-87.

❷ U.S. Land Survey System Identification
Each 6x6 mile square is identified by a township and range number. Each square mile or section within a township is identified by a number from 1-36.
There is also a unique number for each 40 acre parcel or government lot within a section.

❸ Latitude – Longitude Identification
These numbers will make MLMIS compatible with other information gathering systems.

❹ Minor Civil Division Identification
The MCD is the smallest unit of local government. Each MCD is assigned a unique number according to alphabetical order within a county.



Punchcards can be aggregated to create data cells based on MCDs or Townships.

There is a punch card for each 40 acre parcel which contains locational information and data available.

Data Available by 40 Acre Parcel

There are 3 pieces of data available by 40 acre parcel.

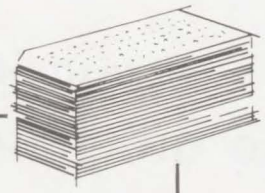
(1) Water Orientation Data
Water orientation is a parcel's relation to water; a lake, river, stream or drainage ditch.

(2) Land Use Data
Land use was determined from aerial photos for each parcel according to nine classes.

(3) Public Ownership Data
Public ownership data is collected for three levels of government: County, State, Federal.

The agency within each level of government which owns or manages the parcel is recorded.

TALAND MANAGEMENT INFORMATION SYSTEM STUDY



MINOR CIVIL DIVISION FILES

By aggregating 40-acre parcels to the MCD level, MLMIS data can be analyzed and summarized in conjunction with other computerized information systems.

(1) Crop and Livestock Reporting Service
This service provides current information on crops and livestock production and prices. It can be used to plan future farming activities, to make production and marketing decisions, and to determine the location of plant and retail facilities.

(2) U.S. Census of Population
The census collects vital statistics and publishes a wide variety of data used for the development and evaulation of economic and social programs.

(3) Rapid Analysis Fiscal Tool (RAFT)
RAFT is a computerized representation of the existing fiscal systems in the state. It is designed to provide a better understanding of the state-local tax and finance system. It can also be used to estimate the impact of change in the system.

Two new files were created and used in conjunction with the MCD files. These temporary files were used in case studies to illustrate the various uses for the MLMIS data.

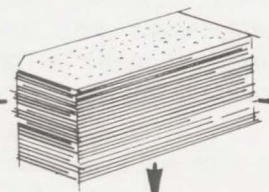
(1) Physical Region File
This file was used to examine in detail the physical, social and economic aspects of a watershed basin.

(2) Economic Region File
This file was used to examine physical, social and economic conditions which were considered in determining the location of a wood processing plant.

TOWNSHIP FILES

By aggregating 40 acre parcels to the township level, MLMIS data is made compatible with other types of information.

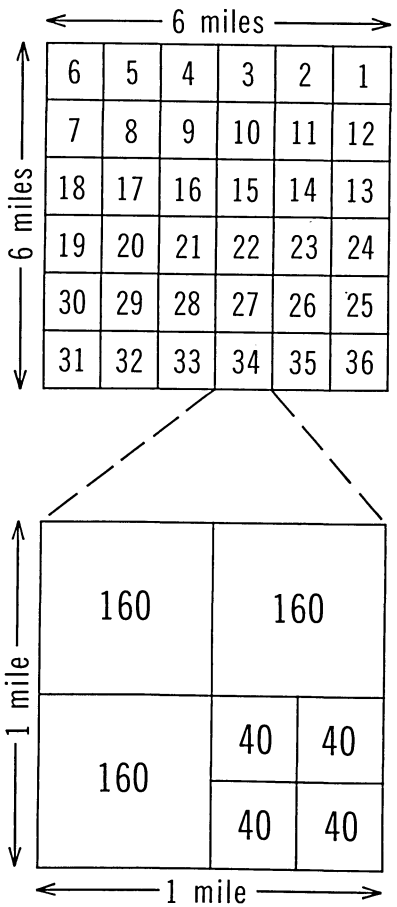
(1) U.S. Forest Service
Information was collected to create a computerized map of original vegetation at the township level. With this data, changes in land use due to the activities of man were examined.



A new file was created and used in conjunction with the township file. This temporary file was used in a case study to illustrate man's impact on the virgin landscape. . .

(1) Vegatation Alteration File
This file was used to examine vegetative alteration as a consequence of white settlement.

Figure 1
DIAGRAM OF THE LAND SURVEY



The township is a survey block six miles on a side, composed of 36 one mile square units, or sections, of 640 acres.

The section is divided into four 160-acre quarter-sections. These quarter-sections are further subdivided into 40-acre parcels. The forty is the smallest unit of the general land survey (if not exactly 40 acres, the parcel is called a government lot). The forty is the basic building block of the MLMIS study.

Chapter II

THE LAND OF THE NORTHWEST REGION [1]

The Broad Pattern

Development Region 1 in the northwestern corner of Minnesota includes Kittson, Roseau, Red Lake, Polk, Marshall, Pennington and Norman counties. This region contains some 5.5 million acres, about 10 percent of the state's area (folded map – State of Minnesota Land Use Development Region 1).

Several groups of features stand out on the Land Use Map of Region 1. One is the vast area of solidly agricultural land in the Red River Valley. This zone forms a belt 20 to 25 miles wide extending from Norman County in the south to Kittson in the north. Ribbons of forested land cross farmlands along rivers such as the Two and Red Lake. Crookston, Thief River Falls, East Grand Forks and smaller cities are urban centers on an otherwise agricultural plain. Crookston, at the intersection of the old Great Northern and Northern Pacific Railroads, has a prominent position. Crookston is one of a line of trade and industrial centers along the Red Lake River from Thief River Falls to Grand Forks.

East of the Red River Valley, agricultural land is mixed with open, forest, and marsh lands. The beach ridges (or old shoreline) of glacial Lake Agassiz separate the "valley" from the area of mixed uses. The approximate position of the beach ridges, and their general north-south alignment, are indicated by the gravel pits (extractive land use) along the transition zone at the east of the valley.

In the northeast portion of Region 1, an extensive area of marsh and open land almost surrounds the farmlands of Roseau County. The marshlands are fringed by open and forest land. Large state and federal wildlife areas comprise much of these wetlands. They include Agassiz National Wildlife Refuge (61,000 acres in west-central Marshall County); Roseau State Wildlife Management Area (54,000 acres in northwest Roseau County); Thief Lake State Wildlife Management Area (32,000 acres in northeast Marshall County); Twin Lake State Wildlife Management Area (8,000 acres in southwest Kittson County). The mixed agricultural-forest region of interior Roseau County is virtually an island surrounded by swampland.

A region of heavily forested land is located in eastern Roseau County. Beltrami Island State Forest lies in this forest belt. Aspen and birch are the dominant forest types, intermixed with spruce.

Ninety-eight percent of the land in Region 1 is in four land-use categories (Table One). Cultivated land dominates, accounting for about 70 percent of the 40-acre data cells. It is followed by forest, 12 percent; pasture and open, 11 percent; and marsh, 5 percent.

Only about one-half of one percent of the region is devoted to urban or transportation uses. The large clusters of urban land are in Polk County. They are the trade centers of East Grand Forks and Crookston and the residential settlement around Maple Lake. The largest number of contiguous residential cells in the region surrounds Maple Lake,[2] making it the development region's most extensive residential area. Numerous residential forties are located in townships immediately surrounding the region's trade centers. In these locations the automobile makes possible commuting to employment centers from relatively high amenity residential areas. These nameless residential areas are increasing in population while other named "places" which were important during the horse-and-buggy era are declining steadily.

[1] Development Region 1, as defined by Executive Order 37, April 3, 1969.

[2] *Minnesota's Lakeshore,* Part II showed about 400 residential structures on the lake, 90 percent of which are seasonal homes.

Table 1 — Distribution of Land Use by Region and Counties (Percent of Forties)

Land Use	Region I	Counties						
		Kittson	Marshall	Norman	Pennington	Polk	Red Lake	Roseau
Forested	11.9	9.5	11.5	4.5	6.6	5.1	9.9	28.4
Cultivated	70.6	67.1	65.2	91.0	81.5	86.6	81.7	42.8
Pasture & Open	10.7	14.3	16.3	3.6	9.2	5.1	6.6	14.4
Water	0.8	.3	1.4	.1	0	1.3	0	.9
Marsh	5.1	8.2	5.2	.2	1.7	.6	.9	13.1
Residential	0.2	.2	.1	.1	.4	.4	.3	.1
Non-Residential or Mixed Residential	0.3	.2	.2	.4	.4	.7	.4	.1
Extractive	0.1	.1	*	.1	.1	.1	.1	*
Transportation	0.1	.1	*	*	.1	.1	.1	*
	100%	100%	100%	100%	100%	100%	100%	100%

Due to rounding, these columns do not total exactly 100%.

*Less than .1%

LAND USE WITHIN THE REGION'S LOCAL GOVERNMENT UNITS

Land Types

In order to simplify the region's land-use picture and make comparisons with census data and county assessor's records, each minor civil division (MCD) in the region was classified in one of six composite land-use types (hereafter called "land-types").[3] Each type has a distinctive pattern and combination of land uses (Table 2, Figure 3). Land use is related to land value, type of agriculture and population characteristics. MCDs of the same land-type have many problems and resources in common. Many government programs and policies affect homogeneous areas in similar ways. Much public agency information is not collected for areas smaller than the MCDs (organized townships and municipalities).

The first four land-types are related to agriculture; the fifth, forest-marsh-open, is not intensively used by man; the sixth is comprised primarily of urban land inside municipal boundaries.

Type I: Cropland. This land-type dominates the map, containing more than one-third of the region's land (Table 2). It is composed of highly productive farmland and occurs primarily in the Red River Valley (the dry lake bed of glacial Lake Agassiz).

[3] A cluster analysis technique was used to create the land-type groups.

Type II: Cropland-Forest-Water. This type is almost exclusively located in the hilly moraine area in the southeastern part of the region. Together with type III, it comprises nearly one-third of the region's total area.

Type III: Cropland-Open. This land-type is located along the beach ridges of Lake Agassiz, in the cropland of Roseau County, and in central Pennington County.

Type IV: Open-Forest-Marsh-Cropland. This type, which makes up over one-fifth of the area, is marginal farmland with significant amounts of unimproved land.

Type V: Forest-Marsh-Open. This land-type is the most marginal agricultural land in the region; only 15 percent of it is devoted to agriculture. The primary uses are for timber, wildlife production and recreation.

Type VI: Urban. This type makes up less than one percent of the region's total area, but contains a large share of both its population and total value of land and improvements.

Investigating land-types further, MLMIS related each type to the regional pattern of land value, public ownership, population density and dominant farm crop.

Figure 3
LAND-TYPES IN DEVELOPMENT
REGION I

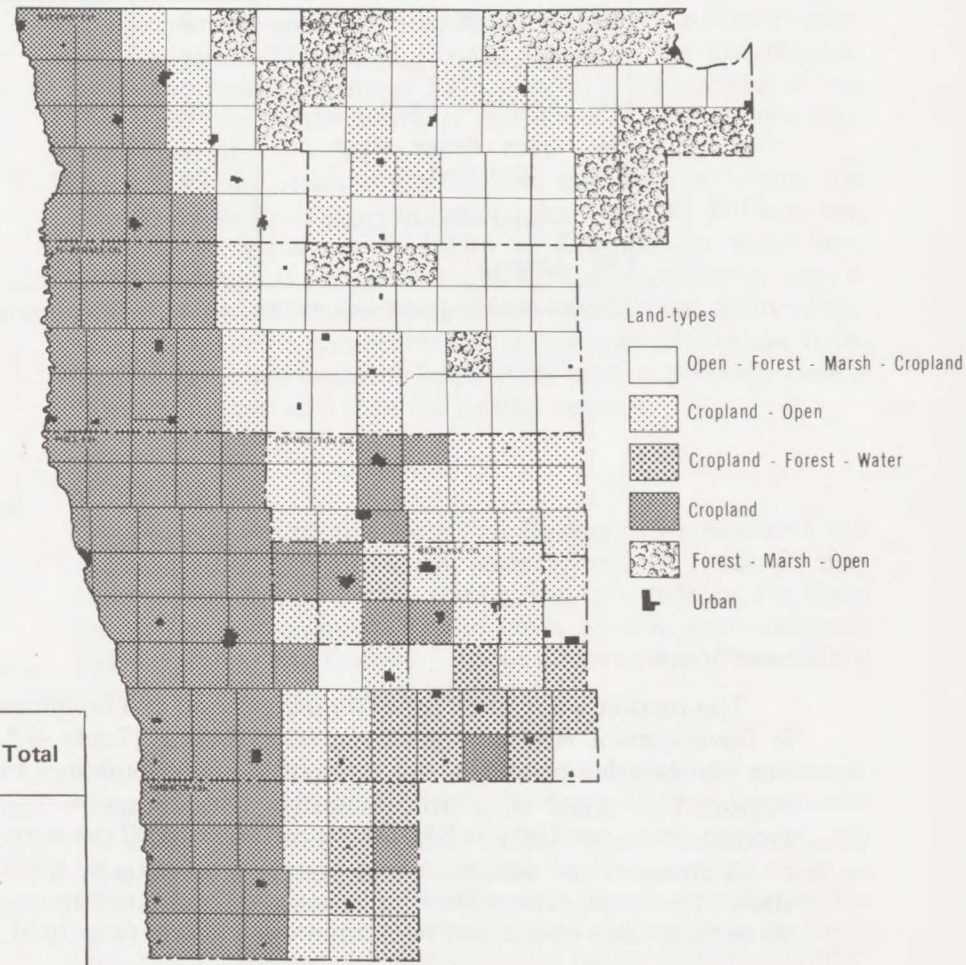


Table 2 — Distribution of Forties by Land-Types

Land-Types		Number of Forties	% of Regional Total
Number	Name		
I	Cropland	48,729	36%
II	Cropland - Forest - Water	9,726	7%
III	Cropland - Open	33,004	24%
IV	Open - Forest - Marsh - Cropland	31,310	23%
V	Forest - Marsh - Open	13,222	10%
VI	Urban	903	*
	Region One Total	136,894	100%

*Less than 1%

Table 3 — Distribution of Land Use Within Each Land-Type (Percent)*

	Forested	Cultivated	Water	Marsh	Urban — Transportation	Extractive	Open	TOTAL
I Cropland	2	96	—	—	—	—	1	100
II Cropland - Forest - Water	14	77	3	1	—	—	4	100
III Cropland - Open	8	77	—	2	—	—	12	100
IV Open - Forest - Marsh - Cropland	20	48	1	7	—	—	23	100
V Forest - Marsh - Open	36	15	2	29	—	—	18	100
VI Urban	9	33	1	—	50	1	7	100

*Due to rounding, each column may not total 100 percent.

Land Value

The market value of all privately owned land and buildings in Development Region 1 is almost $600 million (Table 4).[4] For comparative purposes, the value of land and buildings in Region 1 is equal to a little over five IDS Centers.[5] The average value per forty is $4,100, or just over $100 per acre.

A study of the distribution of average land value by MCD shows five basic categories. The values are distributed among three rural value classes and two urban value classes (Figure 4).

Table 4 — Assessed Valuation of Private Land and Structures — Distribution by Value Class

Value Class	Total Class Value (in 000's)	% of Regional Value	Average Value per Forty	% of Region's Private Forties
Low Rural	86,087	14.4	1,492	46.5
Medium Rural	216,494	36.0	4,270	40.9
High Rural	53,857	9.0	6,953	6.2
Low Urban	84,976	14.2	11,591	5.9
High Urban	158,395	26.4	253,026	.5
Region 1 Total	599,809	100%		100%
Regional Avg.			4,834	

SOURCE: Rapid Analysis Fiscal Tool (RAFT)

Market value was derived from data reported in the abstract of tax lists. This includes all items assessed as real property for taxation.

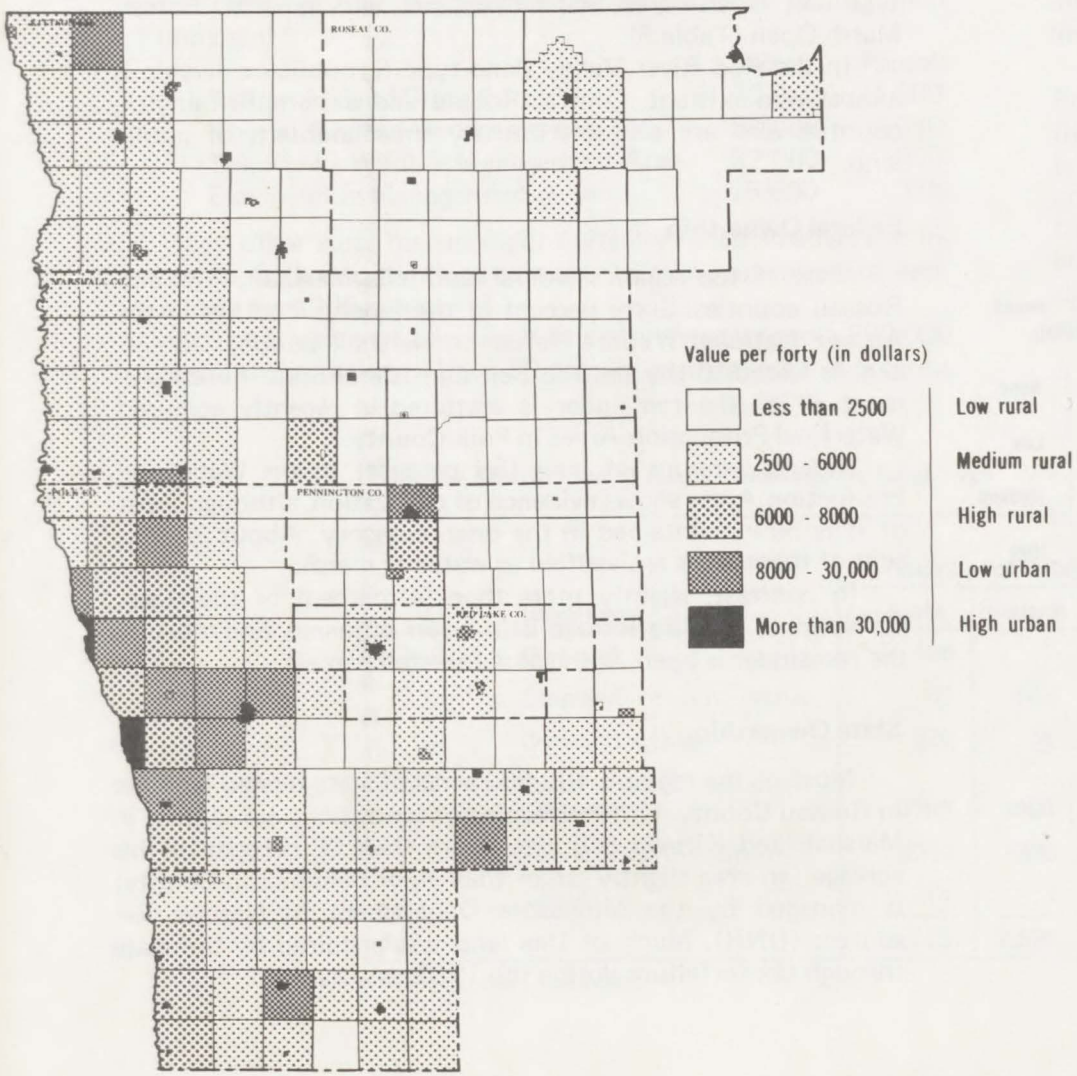
[4] Estimated full and true market value is the value land and improvements could bring if sold.

[5] Investors Diversified Services is constructing, on a block in downtown Minneapolis, an office tower and complex with a publicized value of $120 million.

Figure 4

MARKET VALUE OF LAND AND BUILDINGS

(Average per forty for each Minor Civil Division)



The high-value rural land (ranging from $150 to $200 per acre) is located in the Red River Valley near regional trade centers. The medium-value rural land ($100 per acre) makes up the remainder of the Red River Valley in addition to part of the moraine area in the southeastern corner of the Region and a portion of central Roseau County. The lowest-value rural land (averaging about $37 per acre) is located east of the Red River Valley (land-type I) and north of the moraine area (land-type II).

Almost all urban places (mostly land-type VI), plus the townships surrounding the larger urban centers, fall into the two highest value classes ($200 to $20,000 per acre): low urban and high urban. These urban places account for only 4 percent of the land area, but contain 40 percent of its value. Most of this value is concentrated in the high urban class. Within the high urban class, the larger trade centers generally have a higher value per acre than the smaller centers.

Ownership

Ten percent of the forties in Development Region 1 are owned by the state or federal governments. Of these, 81 percent are controlled by the state.[6] The land held by the state and federal governments would cover an area approximately the size of Norman County.[7] About 92 percent of this publicly owned land is forest, marsh or open.

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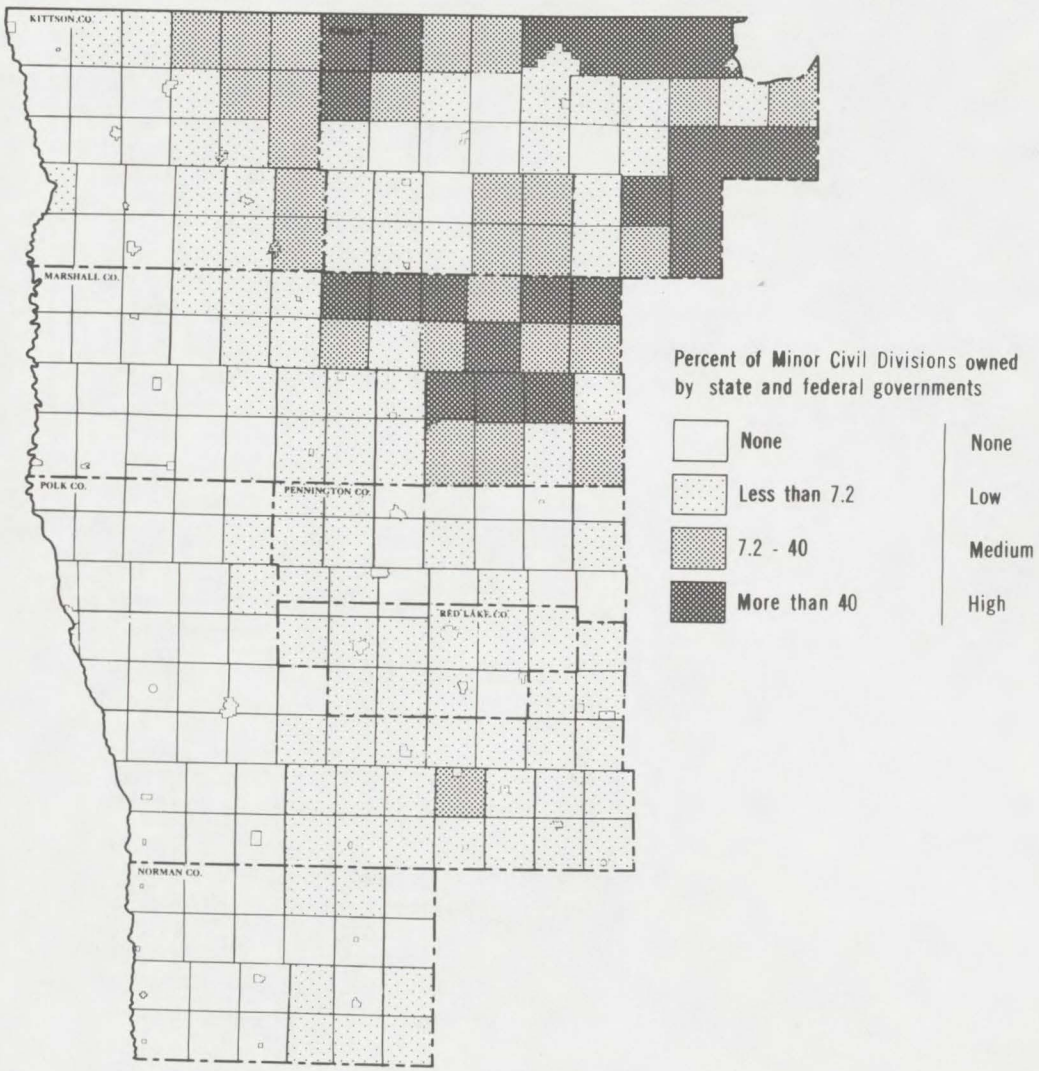
[6] Highway right-of-way land has not been included. Usually it averages about 2 percent of a county's area. (Minnesota Highway Department)

[7] At present only state and federal ownership data is available. County data will be available when the Minnesota State-County Land Classification System is completed by the Minnesota Department of Natural Resources (DNR). Data on state ownership was collected from the Lands and Forestry Division of the Department of Natural Resources. It maintains land ownership records for all DNR land. The remainder of the state-owned land was inventoried by the State Planning Agency from various agency and department files.

Figure 5

STATE AND FEDERAL LAND OWNERSHIP



Public ownership is concentrated in the northeastern part of Development Region 1, primarily in Roseau County; eastern Kittson and eastern Marshall counties also have sizeable quantities (Figure 5).

Almost all this land is concentrated in two land-types: type IV, Open-Forest-Marsh-Cropland, and type V, Forest-Marsh-Open (Table 5).

In the Red River Valley (land-type I), public ownership is almost non-existent. Central Roseau and eastern Pennington counties also are characterized by small amounts of public land.

Federal Ownership

Most of the region's federal land is in Marshall, Polk and Roseau counties. Sixty percent of the federal land lies in the Agassiz National Wildlife Refuge in Marshall County; 25 percent is leased to the state in Beltrami Island State Forest. Almost all of the remainder is scattered in recently acquired Waterfowl Production Areas in Polk County.

A large amount of land (56 percent) in the Waterfowl Production Areas shows evidence of cultivation, although most of it is now maintained in the open category. About 20 percent of these areas is classified as water or marsh.

In contrast, slightly more than 50 percent of the Agassiz National Wildlife Refuge is in water or marsh, and most of the remainder is open, with some forested parcels.

State Ownership

Most of the region's 430,000 acres of state-owned land lies in Roseau County. Other sizeable concentrations are located in Marshall and Kittson counties. More than 98 percent of this acreage (an area slightly larger than all of Pennington County) is managed by the Minnesota Department of Natural Resources (DNR). Much of this land was acquired by the state through tax forfeiture during the 1930s and earlier.

Two DNR divisions have management responsibility for the bulk of the 430,000 acres — Lands and Forestry manages 64 percent, Game and Fish 34 percent. The remaining 2 percent is held by DNR's Division of Parks and Recreation and by other agencies such as the Minnesota Highway Department and the University of Minnesota. The largest state management units are:

	Acres	Parcels
Beltrami Island State Forest	76,000	1,900
Roseau Wildlife Management Area	54,000	1,350
Thief Lake Wildlife Management Area	32,000	800
Elm Wildlife Management Area	15,000	375

Many other state management units are much smaller. For instance, Polk County alone contains 16 management units, each of less than 200 acres.

The Division of Lands and Forestry manages some 280,000 acres in the region. About 50 percent of these parcels is forest land, 18 percent is open, 27 percent is marsh. Table 6 indicates that substantially more of the division's land is outside management units than inside. A principal reason is that the division has held jurisdiction over a significant portion of this acreage only since 1967, when management responsibility was shifted from another division in a legislative reorganization of the department.

As a response to this problem, the Division of Lands and Forestry has nearly completed a land classification study of all the land under its jurisdiction. Consequently, the division now is in a position to (1) determine what specific areas are surplus and should be sold, and (2) begin managing the remainder based on the best use as set out in the classification study. The current land classification will be reviewed and updated periodically as an integral part of the Department of Natural Resources' continuing land-management program.

Table 5 — Distribution of Public Ownership by Land-Type

		Number of Public Parcels			State & Federal Land as a % of all Land in Each Land-Type		
	Land-Type	State	Federal	Total	State	Federal	Total
I	Cropland	126	1	127	*	0	1
II	Cropland - Forest - Water	81	162	243	*	1	2
III	Cropland - Open	820	16	836	6	*	6
IV	Open - Forest - Marsh - Cropland	3709	1008	4717	28	7	35
V	Forest - Marsh - Open	6003	1338	7341	45	9	57
VI	Urban	14	1	15	0	0	0
		10,753	2,526	13,279	83%	17%	100%

*Less than 1 percent

Table 6 — Distribution of State and Federal Ownership by Agency

State	No. Parcels Owned	% of State or Federal Ownership
Agency		
Natural Resources		
Lands & Forestry (State Forest)	1933	18
Lands & Forestry (Outside State Forest)	4961	46
Game & Fish	3681	34
Law Enforcement	7	*
Parks & Recreation	59	*
Highways		
Roadside Park Land	7	*
Maintenance & Storage	4	*
Gravel Pits	61	*
Other State		
Military Affairs	3	*
University of Minnesota	37	*
TOTAL STATE	10,753	100%
Federal		
Agency		
Dept. of Interior, Fish and Wildlife Service		
National Wildlife Refuge	1512	60
Waterfowl Prod. Area	124	5
Waterfowl Easement #	65	3
Land leased to State	652	26
Indian Service	163	6
NWR (flowage)	10	*
TOTAL FEDERAL	2526	100%
TOTAL	13,279	*Less than one %

#Waterfowl Easement. The federal policy is to acquire easements to preserve small wildlife areas and to acquire fee title only on larger units. Minnesota has no easement program for its wildlife management areas.

Crop Types

MLMIS examined crop types in Development Region 1 with the aide of Crop and Livestock Reporting Service data that has been collected at the MCD level in raw form.[8]

The dominant crop type (as determined by total acreage) was recorded for each MCD (Figure 6). All the dominant crops are grains. Oats is the leading crop (in acreage) over the region. It is followed in sequence by hay, wheat and barley.

Oats and hay, which are usually associated with marginal farming areas, are both grown in the lower-value eastern portion of the development region. Wheat and barley dominate the Red River Valley, where the higher value agricultural land is located.

Soils are rich and the amount of rainfall is relatively low in the wheat-barley region. Yearly rainfall, in fact, averages only 19 to 22 inches over the development region (the least among the state's 11 development regions).

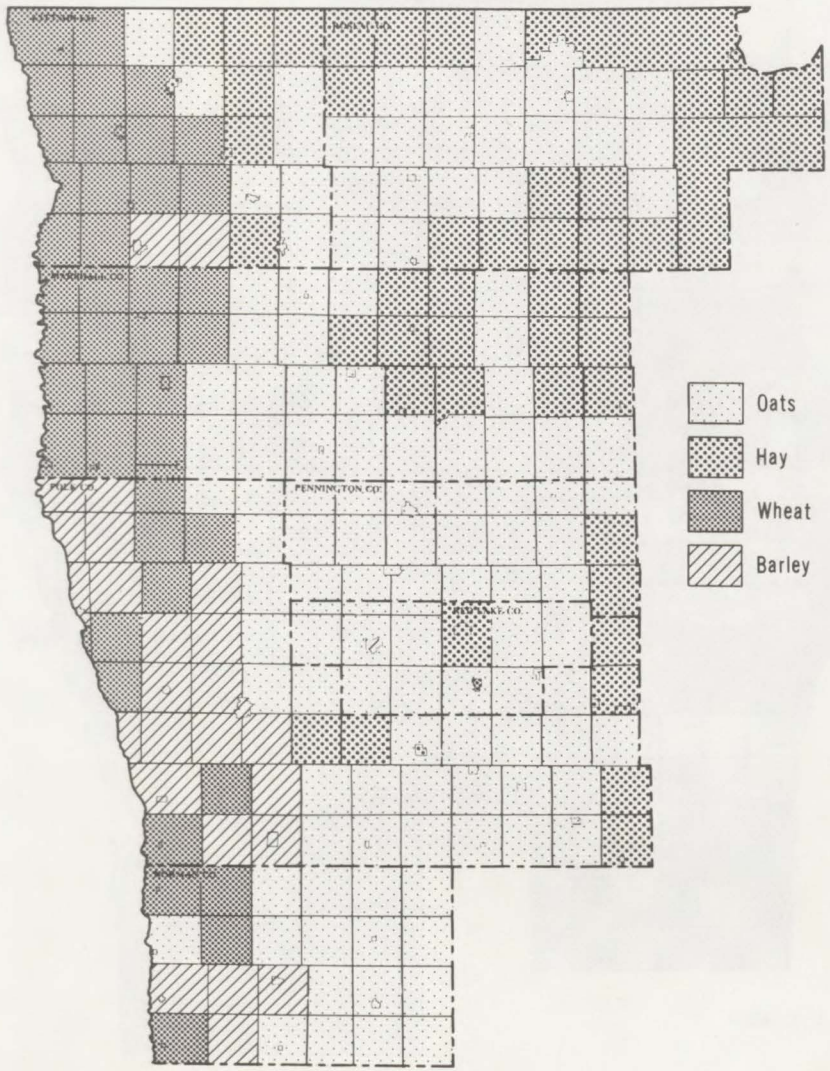
Population

The region's 1970 population was 94,579, or 6.3 percent less than in 1960. Population losses were, in general, in the agricultural areas. Minor civil divisions surrounding the principal trade centers were the most stable, and some gained population (Figure 7).

[8] Raw form: These totals are taken from field reports and do not reflect adjustments to compensate for incomplete reporting. Sugar beets were not reported at the Minor Civil Division level.

Figure 6

DOMINANT CROP (IN ACRES) FOR EACH MINOR CIVIL DIVISION



Source: 1969 data, Crop and Livestock Reporting Service

The majority of the people in the region live at a relatively high density of less than 2.5 acres per person (Table 7, Figure 8). Most of the rest live at lower densities (more than 20 acres per person) in the agricultural areas. Low population densities are strongly associated with land-type V (Forest-Open-Marsh) – in general, the areas with high public land ownership.

Figure 9 shows the population density per acre of private land. It is, of course, a duplicate of Figure 8 in areas of low state and federal government ownership, but there are differences in the northern and eastern parts of the region, where government ownership is high. The map shows that the private land in MCDs with high public ownership is settled as intensively as private land in many other parts of the region.

Table 7 – Population Density Classes

Acres/Person*	1970 Number of People	% of Regional Population
2.5	49640	52
2.6 – 20	2877	3
21 – 160	34914	37
161 – 320	6474	7
321 – 640	655	1
640	19	**
Total 1970	94,579	100%

1960 Population – 100,510

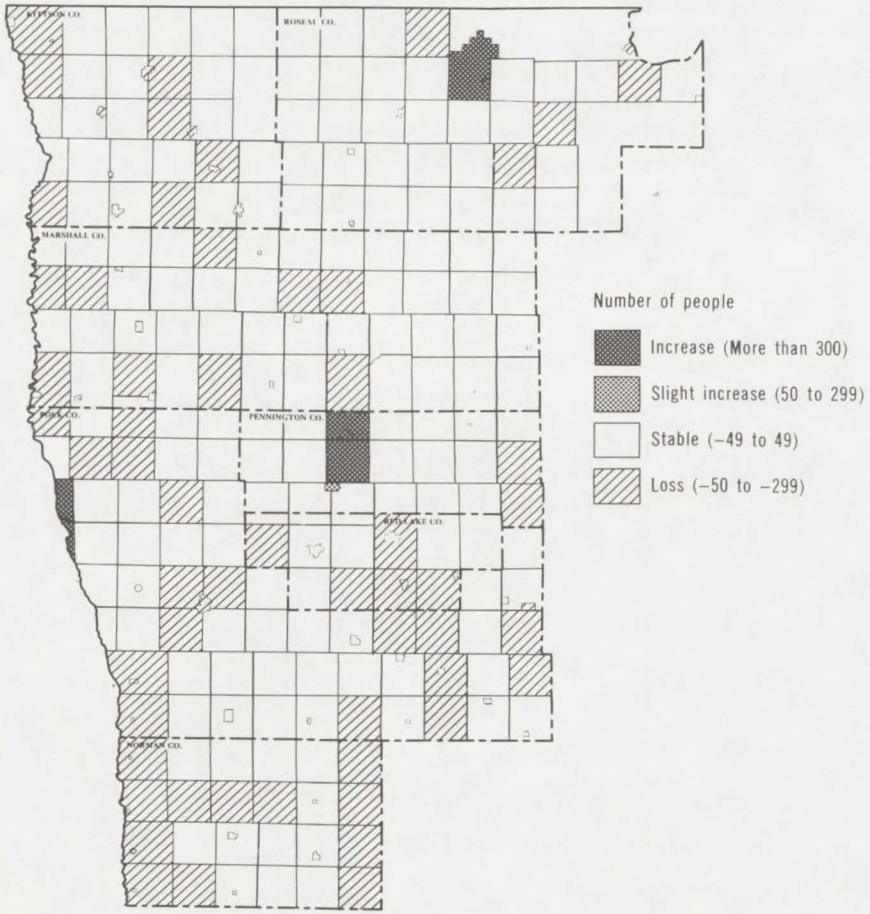
1960-1970 Change, 6.3% Decrease

*1 square mile = 640 acres

**Less than one percent

Figure 7

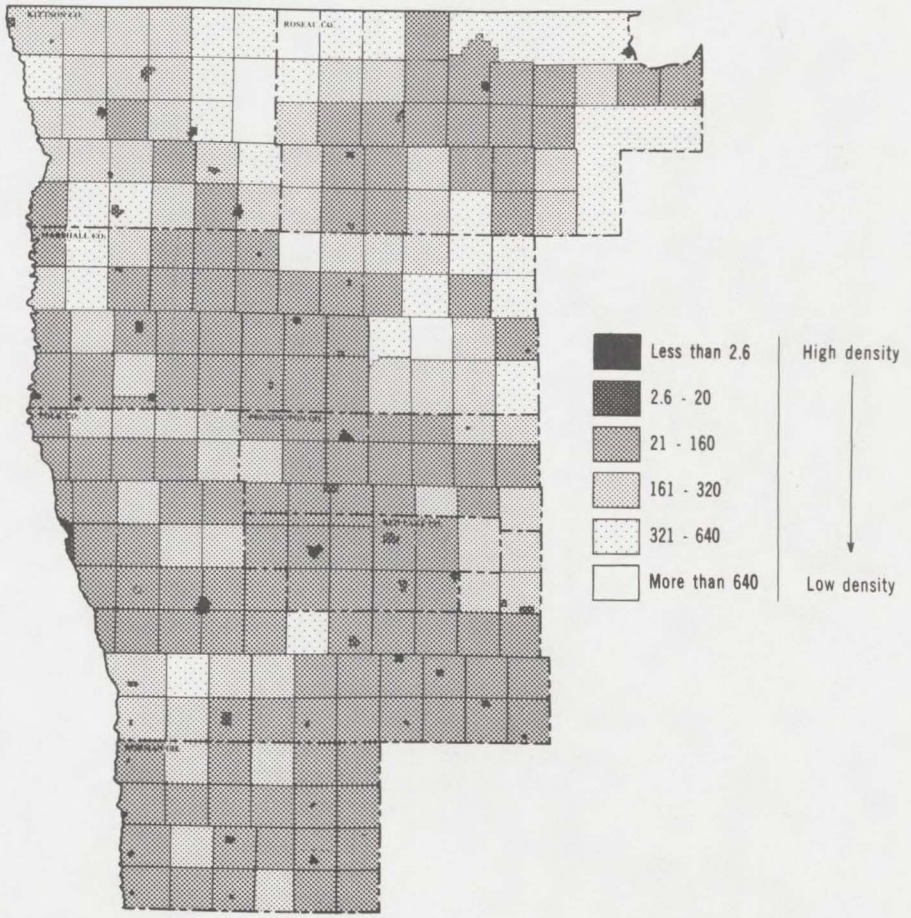
ABSOLUTE POPULATION CHANGE BY MINOR CIVIL DIVISION, 1960 - 1970



Annexation in the 1960's around the regional trade centers of Crookston, Thief River Falls, Roseau, and East Grand Forks necessitated combining population data of these trade centers with surrounding Minor Civil Divisions in which territory was annexed.

Figure 8

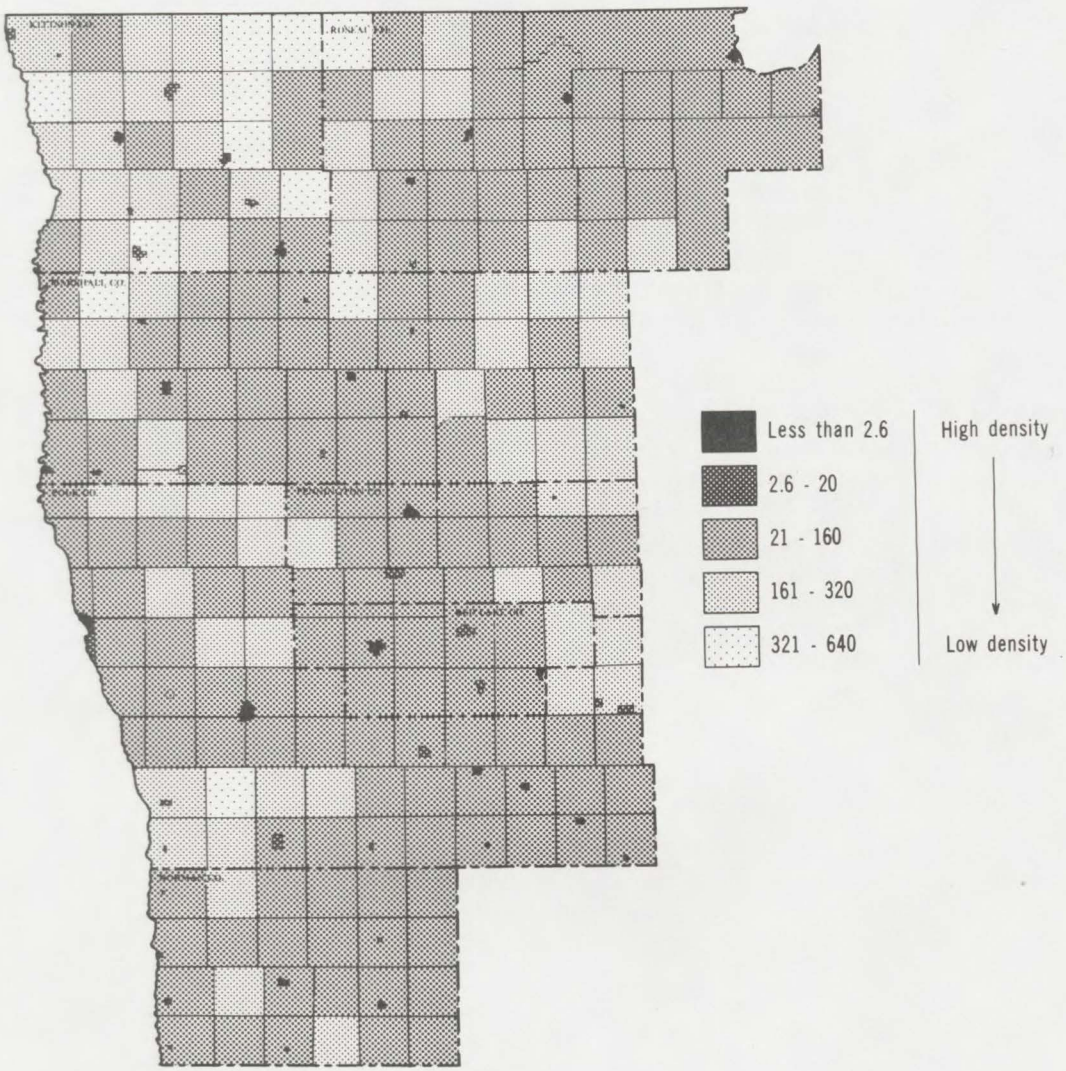
ACRES OF ALL LAND PER PERSON



Source: U. S. Census

Figure 9

ACRES OF PRIVATE LAND PER PERSON



Source: U. S. Census

Chapter III

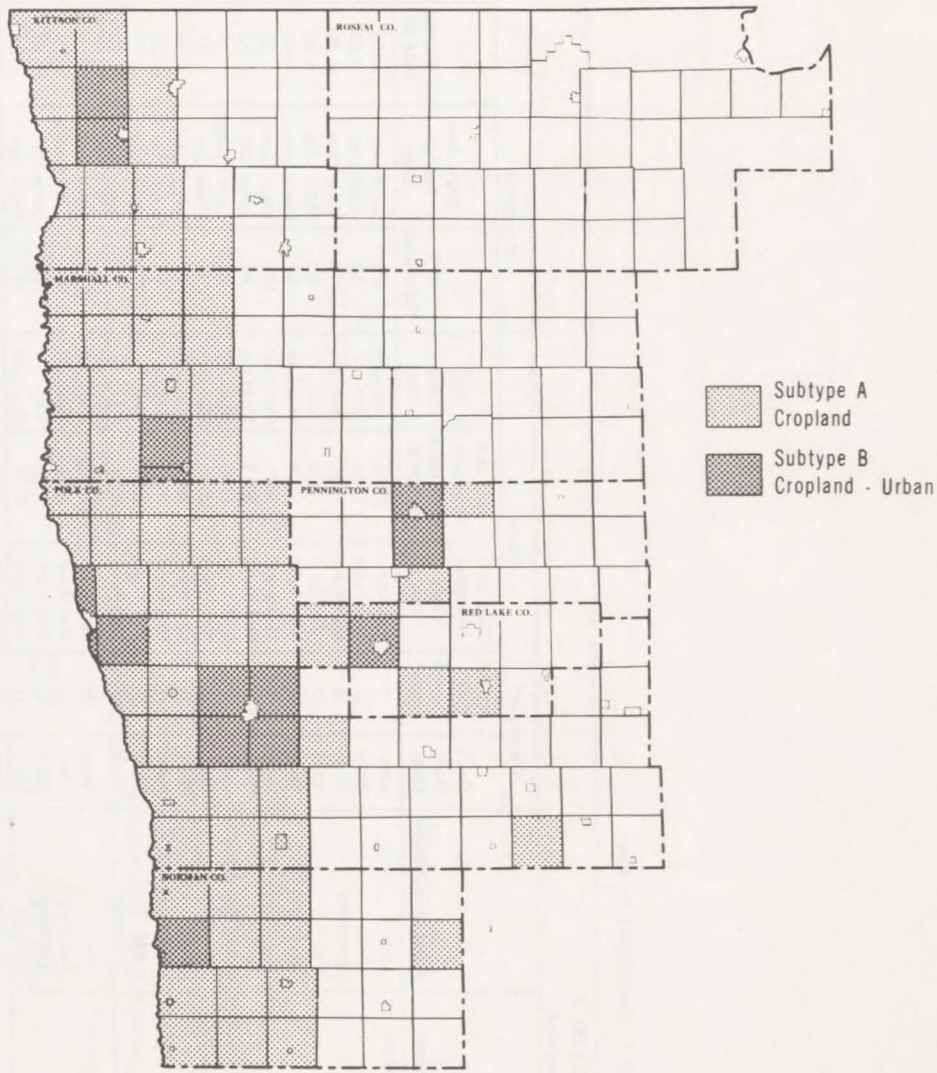
THE PRESENT RESOURCE DEVELOPMENT PATTERN

The land-types introduced in Chapter II were compared in terms of land value, public ownership, population and dominant crop characteristics. Some patterns are apparent: the cropland land-types have medium to high rural land values, medium to low population densities, dominant crops of wheat and barley and low levels of public ownership. In contrast, the land with less cropland has lower value, higher levels of public ownership, and dominant crops of hay and oats.

Because these land-types differ from each other in terms of value, crops, public ownership and population density, public policies can be expected to affect different land-type areas in different ways. Residents of these different areas may have unlike interests in designing public policy. With improved information, public decision-makers will be able to assess the impacts of contemplated policies on various parts of the region. For example, a decrease in reliance on the property-tax rate will have a different impact on the high value land-types than on the low-value ones.

The following maps and tables, organized by land-types, contain information on each minor civil division in Region 1.

Figure 10
LAND-TYPE I
CROPLAND



Land-Type I (Cropland)

The cropland land-type is the most extensive in the region, and is located on the floor of the Red River Valley. It contains 91 rural MCDs, more than one-third of the region's forties and almost one-half its cultivated land. Ninety-six percent of the forties are cultivated.

Land-type I is divided into two sub-types, cropland and cropland/urban, which is composed of the rural townships adjacent to the trade centers. There is almost no government ownership in these MCDs. Almost all are losing population and probably will continue to do so because of increasing farm size. In fact, 22 percent of the MCDs in this region contain fewer than 100 persons. With such small and declining population in many MCDs, there is a question whether all the townships should remain organized. Since almost all MCDs have wheat or barley as the dominant crop, land use throughout the area is affected uniformly by certain Department of Agriculture programs.

Table 8 — Land-Type I Cropland

SUB-TYPE A
Cropland

County	Minor Civil Division	Ownership[1] Gov't Own. Class	Ownership[1] No. of Gov't Owned Parcels	Value[2] Land and Structure Value Class	Value[2] Land and Structures Total Value (in 000's)	Value[2] Pop. Density Class	Population[3] 1970 Population	Population[3] % Population Change Class	Population[3] % Change 1960-70	Agriculture[4] Dominant Crop
Kittson	Clow	Low	2	Low Urban	5945	Med Low	104	Some Loss	– 16	Wheat
	Davis	None	0	Med Rural	2494	Low	68	Major Loss	– 30	Barley
	Grandville	None	0	Med Rural	2031	Med Low	114	Major Loss	– 30	Wheat
	Hill	None	0	Med Rural	2169	Low	63	Major Loss	– 50	Wheat
	North Red River	None	0	Med Rural	1556	Med Low	51	Major Loss	– 41	Oats
	St. Vincent Twp	None	0	Med Rural	3821	Med Low	192	Major Loss	– 37	Wheat
	Skane	None	0	Med Rural	2643	Med Low	88	Some Loss	– 23	Wheat
	South Red River	Low	1	Med Rural	1266	Med Low	57	Little Change	4	Wheat
	Spring Brook	Low	3	Med Rural	2036	Med Low	121	Major Loss	– 37	Barley
	Svea	None	0	Med Rural	2968	Med Low	72	Major Loss	– 38	Wheat
	Tegner	None	0	Med Rural	2536	Med Low	91	Major Loss	– 29	Wheat
	Teien	None	0	Med Rural	2725	Med	220	Major Loss	– 26	Wheat
	Thompson	None	0	Med Rural	2697	Med	226	Some Loss	– 12	Wheat
Marshall	Alma	None	0	Med Rural	1613	Med	188	Some Loss	– 19	Oats
	Augsburg	Low	1	Med Rural	2749	Med	191	Little Change	– 8	Oats
	Big Woods	None	0	Med Rural	2653	Med	185	Some Loss	– 18	Wheat
	Bloomer	None	0	Med Rural	3131	Med Low	121	Major Loss	– 28	Wheat
	Donnelly	None	0	Med Rural	3121	Low	50	Some Loss	– 23	Wheat
	Eagle Point	None	0	Med Rural	2197	Med	170	Little Change	1	Wheat
	Fork	None	0	Med Rural	2058	Med Low	71	Major Loss	– 51	Wheat
	McCrea	None	0	Med Rural	2425	Med	303	Little Change	9	Oats
	Middle River Twp	None	0	Med Rural	2910	Med	187	Little Change	– 4	Wheat
	Oak Park	None	0	Med Rural	3250	Med	253	Some Loss	– 19	Wheat
	Parker	None	0	Med Rural	3032	Med Low	72	Major Loss	– 44	Wheat
	Sinnott	None	0	Med Rural	3222	Med Low	114	Major Loss	– 28	Wheat
	Tamarac	None	0	Med Rural	2868	Med	166	Gain	17	Wheat
	Vega	None	0	Med Rural	4228	Med	228	Some Loss	– 15	Wheat
	Wanger	None	0	Med Rural	2403	Med	233	Some Loss	– 15	Wheat
Norman	Anthony	None	0	Med Rural	3274	Med	183	Some Loss	– 24	Wheat
	Good Hope	None	0	Med Rural	2353	Med Low	122	Some Loss	– 18	Wheat
	Hegne	None	0	Med Rural	3361	Med Low	140	Some Loss	– 12	Barley
	Hendrum Twp	None	0	High Rural	4312	Med	233	Some Loss	– 24	Barley
	Lee	None	0	High Rural	4091	Med	199	Major Loss	– 27	Wheat
	Lockhart	Low	1	Med Rural	3073	Med	167	Some Loss	– 20	Oats
	McDonaldsville	None	0	Low Urban	5126	Med	309	Little Change	3	Barley
	Mary	None	0	Med Rural	3396	Med	187	Major Loss	– 30	Barley
	Pleasantview	None	0	Med Rural	3369	Med	217	Some Loss	– 22	Oats
	Shelly Twp	None	0	Med Rural	3974	Med	261	Major Loss	– 26	Oats
	Wankon	None	0	Med Rural	2190	Med	281	Some Loss	– 23	Oats
	Winchester	None	0	Med Rural	3077	Med	151	Some Loss	– 15	Oats
Pennington	River Falls	None	0	Med Rural	963	Med	171	Some Loss	– 16	Oats
	Silverton	None	0	Low Rural	1014	Med	203	Little Change	1	Oats
Polk	Angus	Low	1	High Rural	3335	Med	179	Some Loss	– 18	Wheat
	Belgium	Low	4	High Rural	1215	Med	150	Little Change	7	Oats
	Brant	Low	21	Low Rural	973	Med Low	113	Some Loss	– 19	Oats
	Brislet	Low	2	Med Rural	1723	Med Low	104	Some Loss	– 19	Oats
	Bygland	None	0		3736	Med	352	Little Change	9	Wheat
	Ester	Low	0	Med Rural	2188	Med	154	Some Loss	– 21	Oats
	Euclid	Low	8	Med Rural	2811	Med	233	Major Loss	– 25	Barley
	Fanny	None	0	Med Rural	3422	Med Low	137	Some Loss	– 16	Barley
	Farley	None	0	High Rural	2615	Med Low	75	Major Loss	– 43	Wheat
	Fischer Twp	None	0	Low Urban	5321	Med	542	Little Change	8	Barley
	Hammond	None	0	Med Rural	3417	Low	63	Some Loss	– 18	Wheat
	Hedgeland	None	0	Low Rural	847	Med Low	85	Some Loss	– 13	Oats
	Higden	None	0	Med Rural	2245	Med	124	Major Loss	– 33	Barley
	Hubbard	None	0	High Rural	4369	Med Low	162	Major Loss	– 32	Wheat
	Kertsonville	Low	19	Low Rural	1153	Med	197	Little Change	– 7	Hay
	Keystone	None	0	High Rural	4109	Med Low	122	Major Loss	– 25	Wheat
	Nesbit	None	0	High Rural	4338	Med	158	Some Loss	– 20	Barley
	Northland	None	0	High Rural	3973	Med	287	Some Loss	– 16	Barley
	Parnell	None	0	Med Rural	1817	Med Low	98	Some Loss	– 23	Oats
	Reis	Low	1	Med Rural	2821	Med	138	Major Loss	– 33	Barley
	Roome	None	0	High Rural	3816	Med	268	Little Change	– 5	Barley
	Russia	None	0	Med Rural	3084	Med Low	85	Major Loss	– 48	Barley
	Sandsville	None	0	Med Rural	2429	Med Low	84	Some Loss	– 21	Barley
	Scandia	None	0	Med Rural	2888	Med Low	126	Some Loss	– 13	Barley
	Slatten	Low	6	Med Rural	2868	Med	220	Some Loss	– 19	Barley

	Parnell	None	0	Med Rural	1877	Med Low	138	Major Loss	– 33	Barley
	Reis	Low	1	Med Rural	2821	Med	268	Little Change	– 5	Barley
	Roome	None	0	High Rural	3816	Med	85	Major Loss	– 48	Barley
	Russia	None	0	Med Rural	3084	Med Low				
	Sandsville	*None*	*0*	*Med Rural*	*2429*	*Med Low*	*84*	*Some Loss*	*– 21*	*Barley*
	Scandia	*None*	*0*	*Med Rural*	*2888*	*Med Low*	*126*	*Some Loss*	*– 13*	*Barley*
	Sletten	Low	6	Med Rural	2260	Med	213	Major Loss	– 28	Oats
	Sullivan	None	0	High Rural	3978	Med	213	Little Change	3	Barley
	Tabor	None	0	Low Urban	5401	Med	217	Some Loss	– 19	Wheat
	Tynsid	None	0	Low Urban	4515	Med	83	Major Loss	– 26	Hay
	Vineland	None	0	Low Urban	8453	Med Low	150	Major Loss	– 34	Barley
Red Lake	Brown's Creek	None	0	Med Rural	578	Med	78	Some Loss	– 15	Oats
	Louisville	Low	13	Low Rural	1367	Med	239	Major Loss	– 25	Oats
	Poplar River	Low	7	Low Rural	1385	Med	265	Some Loss	– 17	Oats
	Terrebone	Low	4	Med Rural	1482	Med	233	Major Loss	– 32	Oats
	Wylie	None	0	Med Rural	451	Med	111	Some Loss	– 11	Oats

SUBTOTAL A	Total Parcels	Total Value	Total Population	Average Change
	94	218,935	12,661	– 18

SUB-TYPE B
Cropland-Urban

		Ownership[1]		Value[2]			Population[3]			Agriculture[4]
County	Minor Civil Division	Gov't Own. Class	No. of Gov't Owned Parcels	Land and Structure Value Class	Land and Structures Total Value (in 000's)	Pop. Density Class	1970 Population	% Population Change Class	% Change 1960-70	Dominant Crop
Marshall	Boxville	None	0	Low Urban	2380	Med Low	72	Some Loss	– 20	Wheat
	Warrenton	None	0	Med Rural	3313	Med Low	119	Major Loss	– 30	Wheat
Pennington	North	None	0	Low Urban	3870	Med	652	Major Loss	– 34	Oats
	Rocksbury	Low	2	High Rural	4141	Med	669	Little Change	– 1	Oats
Red Lake	Red Lake Falls Twp	Low	1	Med Rural	1631	Med	232	Little Change	– 6	Oats
Norman	Halstad Twp	None	0	High Rural	4664	Med	255	Some Loss	– 23	Oats
Polk	Andover	None	0	Low Urban	5054	Med	184	Little Change	7	Barley
	Crookston Twp	Low	15	Low Urban	5083	Med	580	Gain	63	Oats
	Fairfax	Low	1	Med Rural	2957	Med	270	Little Change	– 8	Barley
	Grand Forks	None	0	Low Urban	3195	Med	357	Gain	38	Barley
	Huntsville	None	0	Low Urban	9065	Med	461	Little Change	1	Wheat
	Lowell	Low	14	Low Urban	10712	Med	217	Major Loss	– 48	Barley
	Rhinehart	None	0	High Urban	2083	High	416	Gain	89	Wheat
Kittson	Hallock Twp	None	0	Med Rural	2464	Med Low	119	Some Loss	– 20	Wheat
	Hampden	None	0	Med Rural	2379	Med Low	84	Major Loss	– 24	Wheat

SUBTOTAL B	Total Parcels	Total Value	Total Population	Average Change
	33	62,991	4687	10%

TOTAL A & B	Total Parcels	Total Value	Total Population	Average Change
	127	281,926	17348	16%

[1] Ownership classes from Figure 5.

[2] Value classes from Figure 4.

[3] Density classes from Figure 8; Change classes from Figure 7.

[4] Dominant crop from Figure 6.

Land-Type II (Cropland-Forest-Water)

This land-type occupies 6 percent of the Region 1 land area, but contains 29 percent of the region's water. Land-type II is divided into two sub-types, cropland-forest-water and cropland-forest (Table 9).

Land-type II is located almost exclusively in the southwest part of the region in a glacial moraine area. The area has a declining population, but it is more densely settled than land-type I. There is some scattered government ownership for waterfowl production. The dominant crop is oats.

Figure II
LAND-TYPE II
CROPLAND - FOREST - WATER

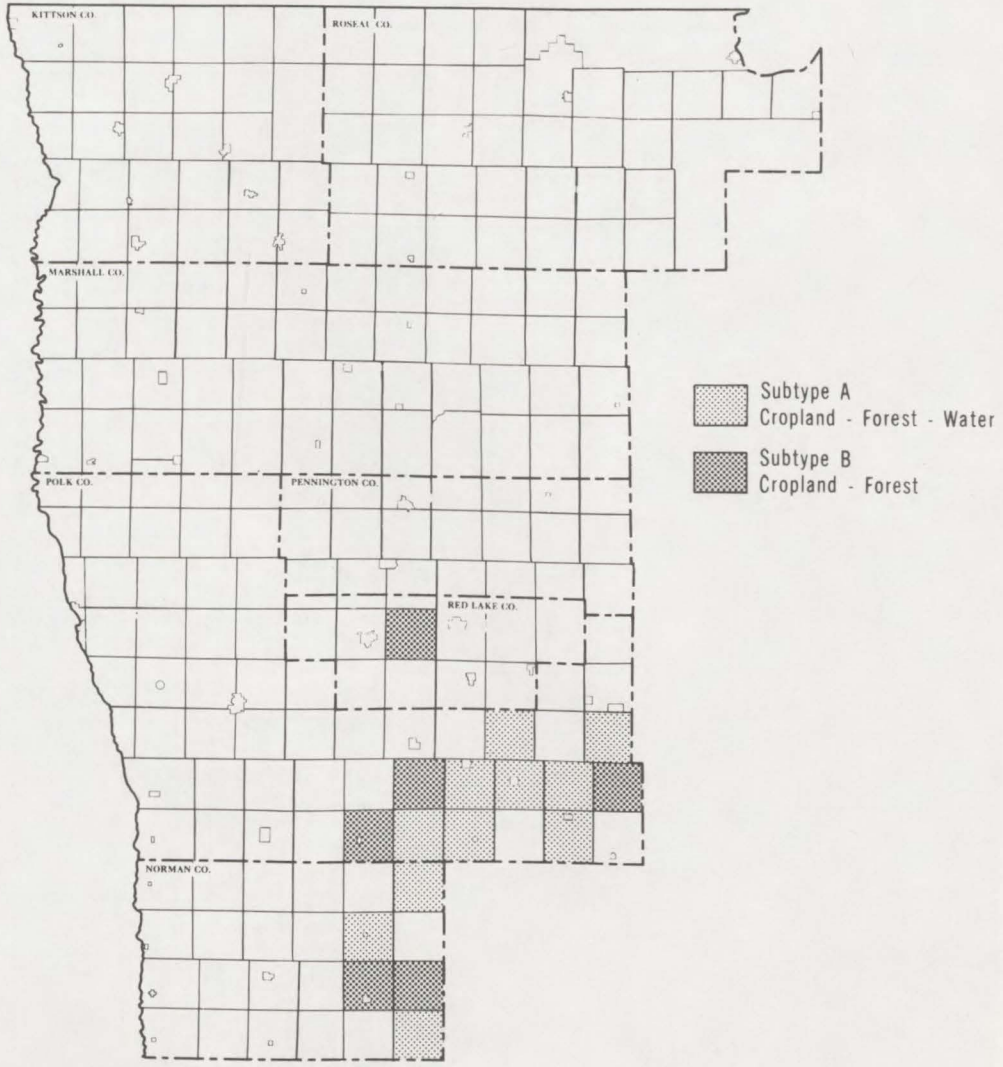


Table 9 – Land-Type II Cropland-Forest-Water

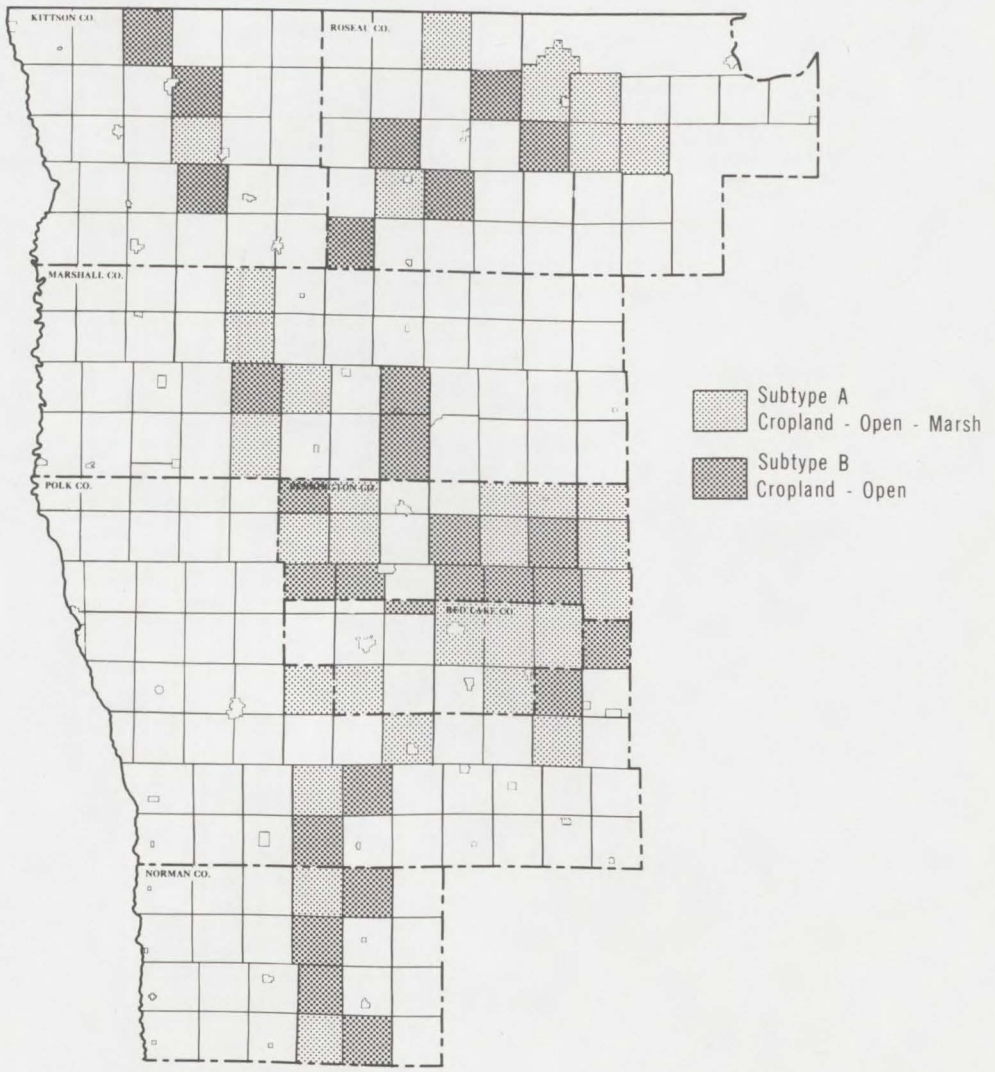
SUB-TYPE A
Cropland-Forest-Water

		Ownership		Value			Population			Agriculture
County	Minor Civil Division	Gov't Own. Class	No. of Gov't Owned Parcels	Land and Structure Value Class	Land and Structures Total Value (in 000's)	Pop. Density Class	1970 Population	% Population Change Class	% Change 1960-70	Dominant Crop
Norman	Bear Park	None	0	Med Rural	1905	Med	349	Some Loss	– 16	Oats
	Flom	Low	7	Med Rural	2451	Med	312	Major Loss	– 26	Oats
	Strand	None	0	Low Rural	1383	Med	193	Some Loss	– 15	Oats
Polk	Brandsvold	Low	17	Med Rural	1994	Med	318	Little Change	– 8	Oats
	Eden	Low	4	Med Rural	1649	Med	273	Some Loss	– 23	Oats
	Garden	Low	12	Med Rural	2306	Med	305	Major Loss	– 29	Oats
	King	Low	13	Med Rural	1718	Med	236	Some Loss	– 22	Oats
	Knute	Med	47	Med Rural	1908	Med	403	Some Loss	– 11	Oats
	Lessor	Low	30	Low Rural	1337	Med	206	Some Loss	– 23	Oats
	Rosebud	Low	23	Med Rural	1705	Med	354	Little Change	– 3	Oats
	Winger Twp	Low	16	Med Rural	6585	Med	281	Some Loss	– 10	Oats
	SUBTOTAL A		Total Parcels		Total Value		Total Population		Average Change	
			169		24,671		3230		– 17%	

SUB-TYPE B
Cropland-Forest

		Ownership		Value			Population			Agriculture
County	Minor Civil Division	Gov't Own. Class	No. of Gov't Owned Parcels	Land and Structure Value Class	Land and Structures Total Value (in 000's)	Pop. Density Class	1970 Population	% Population Change Class	% Change 1960-70	Dominant Crop
Norman	Fossum	Low	11	Med Rural	1853	Med	260	Major Loss	– 18	Oats
	Wild Rice	None	0	Med Rural	1793	Med	462	Little Change	7	Oats
Polk	Garfield	Low	16	Med Rural	2665	Med	408	Little Change	2	Oats
	Queen	Low	13	Med Rural	1512	Med	291	Major Loss	– 26	Hay
	Woodside	Low	32	Med Rural	2720	Med	297	Some Loss	– 13	Oats
Red Lake	Gervais	Low	2	Low Rural	1297	Med	274	Some Loss	– 15	Oats
	SUBTOTAL B		Total Parcels		Total Value		Total Population		Average Change	
			74		11,840		1992		– 9%	
	TOTAL A & B		Total Parcels		Total Value		Total Population		Average Change	
			243		36,511		5222		– 14%	

Figure 12
LAND-TYPE III
CROPLAND - OPEN



Land-Type III (Cropland-Open)

Type III occupies 25 percent of Development Region 1. Sub-types include cropland-open and cropland-open-marsh.

Land in this class is concentrated in three areas: central Roseau County; eastern Pennington and Red Lake Counties; the north-south line following the Lake Agassiz beach ridges. These ridges have coarse, permeable soils and are cultivated less extensively than the clay soils to the west. Oats are the dominant crop. Gravel pits scattered along the beach ridges make up over half the region's extractive land use area. There is very little government owned land, and rural land values are generally low. The population is generally declining.

Table 10 – Land-Type III Cropland-Open

SUB-TYPE A
Cropland-Open-Marsh

		Ownership		Value			Population			Agriculture
County	Minor Civil Division	Gov't Own. Class	No. of Gov't Owned Parcels	Land and Structure Value Class	Land and Structures Total Value (in 000's)	Pop. Density Class	1970 Population	% Population Change Class	% Change 1960-70	Dominant Crop
Kittson	Hazelton	Low	1	Low Rural	1157	Med Low	130	Major Loss	– 38	Wheat
Marshall	Comstock	None	0	Med Rural	1805	Med	211	Some Loss	– 20	Oats
	Marsh Grove	Low	1	Low Rural	1181	Med	181	Little Change	– 2	Oats
	Nelson Park	Low	11	Low Rural	1000	Med	170	Major Loss	– 31	Oats
	Wright	Low	39	Med Rural	3249	Med	247	Little Change	– 9	Oats
Norman	Rockwell	Low	11	Low Rural	1067	Med Low	99	Major Loss	– 27	Oats
	Spring Creek	Low	42	Med Rural	1342	Med	141	Little Change	– 5	Oats
Pennington	Bray	Low	22	Low Rural	797	Med Low	98	Some Loss	– 12	Oats
	Clover Leaf	None	0	Low Rural	1005	Med	120	Some Loss	– 10	Oats
	Goodridge Twp	None	0	Low Rural	591	Med Low	69	Little Change	9	Oats
	Hickory	None	0	Low Rural	554	Med Low	96	Major Loss	– 36	Hay
	Kratka	None	0	Low Rural	1255	Med	153	Some Loss	– 23	Oats
	Norden	Low	13	Low Rural	899	Med	208	Little Change	0	Oats
	Reiner	None	0	Low Rural	484	Med Low	101	Some Loss	– 21	Oats
	Sanders	Low	6	Low Rural	1007	Med	254	Some Change	– 10	Oats
	Star	Low	2	Low Rural	702	Med	180	Major Loss	– 28	Hay
Polk	Gentilly	None	0	Med Rural	3276	Med	395	Little Change	– 7	Oats
	Grove Park	Low	3	Med Rural	1666	Med	257	Little Change	– 8	Oats
	Hill River	Low	19	Med Rural	1640	Med	238	Some Loss	– 16	Oats
	Onstad	Low	37	Low Rural	1100	Med Low	121	Major Loss	– 27	Oats
Red Lake	Emardville	Low	8	Med Rural	1888	Med	318	Some Loss	– 14	Hay
	Equality	Low	6	Low Rural	1283	Med Low	183	Major Loss	– 36	Oats
	Garnes	Low	7	Low Rural	1397	Med	237	Some Loss	– 12	Oats
	Lake Pleasant	Low	4	Low Rural	1156	Med	164	Some Loss	– 21	Oats
	Lambert	None	0	Low Rural	1286	Med	240	Major Loss	– 27	Oats
Roseau	Falum	Low	7	Low Rural	1043	Med	207	Major Loss	– 31	Oats
	Hereim	Low	5	Low Rural	904	Med	245	Some Loss	– 11	Oats
	Jadis	Low	13	Med Rural	4544	Med	425	Some Loss	– 18	Oats
	Malung	None	0	Med Rural	1488	Med	310	Little Change	– 8	Oats
	Pohlitz	Med	343	Low Rural	486	Med Low	66	Major Loss	– 35	Hay
	Spruce	Low	1	Med Rural	1666	Med	297	Little Change	5	Oats
	SUBTOTAL A		Total Parcels		Total Value		Total Population		Average Change	
			601		42,918		6161		17%	

SUB-TYPE B
Cropland-Open-Marsh

Kittson	Jupiter	Low	30	Med Rural	1580	Med	203	Some Loss	– 19	Wheat
	Poppleton	Low	1	Low Rural	799	Med Low	136	Major Loss	– 38	Oats
	Richardville	Low	10	Low Rural	1366	Med Low	162	Some Loss	– 17	Oats
Marshall	Excel	Low	16	Low Rural	1685	Med	229	Some Loss	– 23	Oats
	Foldahl	Low	9	Low Rural	1169	Med	161	Some Loss	– 11	Oats
	Holt Twp	Low	1	Low Rural	874	Med	193	Little Change	– 4	Hay
Norman	Green Meadow	None	0	Med Rural	1837	Med	91	Major Loss	– 27	Oats
	Home Lake	Low	33	Med Rural	1413	Med	216	Some Loss	– 14	Oats
	Lake Ida	Low	3	Med Rural	1731	Med	198	Some Loss	– 18	Oats
	Sundal	Low	2	Med Rural	1601	Med	227	Some Loss	– 13	Oats
Pennington	Black River	Low	4	Low Rural	792	Med	104	Little Change	– 9	Oats
	Deer Park	None	0	Low Rural	593	Med	181	Little Change	– 0	Oats
	Highlanding	Low	2	Low Rural	1008	Med	209	Some Loss	– 14	Oats
	Mayfield	Low	1	Low Rural	529	Med Low	69	Major Loss	– 36	Oats
	Numedal	Low	9	Low Rural	616	Med	113	Little Change	– 8	Oats
	Polk Centre	Low	12	Low Rural	722	Med	124	Little Change	9	Oats
	Smiley	Low	4	Low Urban	1404	Med	274	Little Change	– 3	Oats
	Wyandotte	None	0	Low Rural	744	Med	119	Some Loss	– 18	Oats
Polk	Chester	Low	1	Low Rural	776	Med Low	116	Major Loss	– 25	Oats
	Godfrey	Low	32	Med Rural	1528	Med	266	Little Change	– 9	Oats
	Johnson	Low	12	Low Rural	833	Med Low	114	Some Loss	– 14	Hay
	Liberty	Low	34	Med Rural	1439	Med	150	Some Loss	– 24	Oats
Roseau	Barnet	None	0	Low Rural	851	Med	214	Little Change	– 1	Oats
	Barto	None	0	Low Rural	934	Med	181	Little Change	0	Oats
	Lind	Low	16	Low Rural	615	Med Low	83	Little Change	5	Oats
	Ross	None	0	Low Rural	988	Med	214	Little Change	– 1	Oats
	Stafford	Low	3	Low Rural	1205	Med	201	Some Loss	– 18	Oats
Red Lake	River	None	0	Low Rural	441	Med	90	Some Loss	– 22	Oats
	SUBTOTAL B		Total Parcels		Total Value		Total Population		Average Change	
			235		30,074		4738		– 14%	
	TOTAL A & B		Total Parcels		Total Value		Total Population		Average Change	
			836		72,992		10899		– 15%	

Land-Type IV (Open-Forest-Marsh-Cropland)

This land-type, the most diverse of the six, accounts for 23 percent of the region's land area. It includes three sub-types: (A) open-marsh-cropland; (B) open-forest-marsh-cropland; and (C) open-forest-cropland. Though cultivated land is the dominant category in about half the parcels in this classification, the land is marginal for agriculture. The dominant crops are oats and hay, neither high value crops. There is a significant amount of government ownership; land values are low; and there is some population decline. Nineteen Minor Civil Divisions have populations of fewer than 100 persons. Here, as in the Red River Valley, there may be a need to consolidate or dissolve civil divisions which have few people.

Figure 13
LAND-TYPE IV
OPEN - FOREST - MARSH - CROPLAND

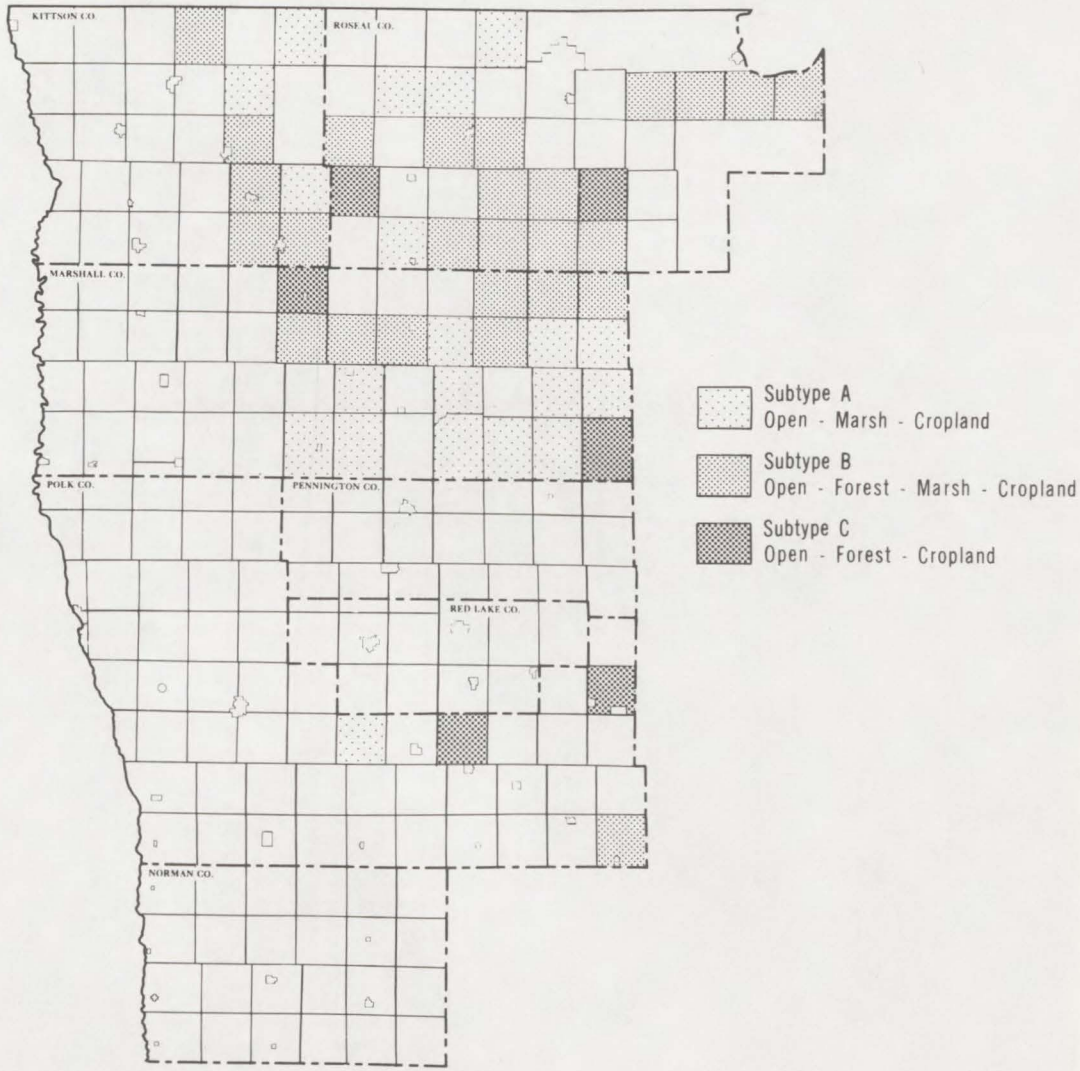


Table 11 – Land-Type IV Open-Forest-Marsh-Cropland

SUB-TYPE A
Open-Marsh-Cropland

		Ownership		Value			Population			Agriculture
County	Minor Civil Division	Gov't Own. Class	No. of Gov't Owned Parcels	Land and Structure Value Class	Land and Structures Total Value (in 000's)	Pop. Density Class	1970 Population	% Population Change Class	% Change 1960-70	Dominant Crop
Kittson	Cannon	Med	159	Low Rural	278	Low	43	Major Loss	– 42	Hay
	Caribou	Med	55	Low Rural	357	Low	78	Gain	11	Hay
	Pelan	Med	46	Low Rural	514	Low	51	Major Loss	– 43	Oats
Marshall	Agder	Med	292	Low Rural	582	Med	116	Some Loss	– 19	Oats
	Cedar	Med	122	Low Rural	616	Med	164	Little Change	– 4	Hay
	East Valley	High	288	Low Rural	308	Med Low	68	Some Loss	– 20	Hay
	Eckvoll	High	253	Low Rural	356	Med	88	Some Loss	– 24	Hay
	Grand Plain	Med	208	Low Rural	622	Med Low	98	Some Loss	– 15	Oats
	Moylan	Low	29	Low Rural	788	Med Low	158	Little Change	– 1	Oats
	New Folden	Low	6	Low Rural	990	Med	212	Little Change	1	Oats
	New Solum	Low	19	Low Rural	1153	Med	258	Little Change	– 6	Oats
	Rollis	Med	68	Low Rural	344	Med	182	Little Change	– 9	Hay
	Valley	Low	20	Low Rural	1329	Med	237	Little Change	– 5	Hay
	Veldt	Med	176	Low Rural	331	Med Low	62	Little Change	– 3	Hay
	Viking Twp	Low	4	High Rural	5486	Med	274	Little Change	– 5	Oats
Polk	Tilden	Low	14	Low Rural	425	Low	52	Little Change	4	Hay
Roseau	Deer	Low	2	Low Rural	687	Med	153	Some Loss	– 17	Oats
	Dieter	Med	74	Low Rural	1138	Med	209	Some Loss	– 20	Oats
	Moose	Low	9	Low Rural	783	Med Low	131	Little Change	– 8	Oats
	Soler	Med	61	Low Rural	575	Med Low	116	Some Loss	– 16	Oats
	SUBTOTAL A		Total Parcels		Total Value		Total Population		Average Change	
			1905		17,622		2750		– 21%	

SUB-TYPE B
Open-Forest-Marsh-Cropland

Kittson	Arveson	Med	189	Low Rural	369	Med Low	87	Major Loss	– 25	Oats
	Deerwood	Low	14	Low Rural	907	Med	180	Some Loss	– 20	Hay
	Norway	Low	22	Low Rural	677	Med Low	90	Major Loss	– 36	Oats
	Percy	Low	39	Low Rural	791	Low	54	Gain	15	Hay
	St. Joseph	Med	176	Low Rural	477	Med Low	101	Some Loss	– 18	Hay
Marshall	Linsell	High	270	Low Rural	204	Med Low	39	Some Loss	– 19	Hay
	Moose River	High	298	Low Rural	226	Med Low	70	Some Loss	– 20	Hay
	New Maine	Med	52	Low Rural	609	Med	169	Some Loss	– 23	Hay
	Spruce Valley	Low	26	Low Rural	839	Med	247	Some Loss	– 20	Hay
	Thief Lake	Med	191	Low Rural	294	Med Low	85	Some Loss	– 23	Oats
	West Valley	Low	10	Low Rural	885	Med	204	Some Loss	– 19	Oats
	Whiteford	High	353	Low Rural	344	Med Low	45	Major Loss	– 33	Oats
Polk	Columbia	Low	33	Med Rural	1606	Med	405	Little Change	– 7	Hay
Roseau	Cedarbend	Med	124	Low Rural	602	Med	118	Major Loss	– 25	Hay
	Enstrom	Low	46	Low Rural	990	Med	196	Some Loss	– 18	Oats
	Golden Valley	Low	41	Low Rural	429	Med	165	Gain	17	Hay
	Grimstad	Med	54	Med Rural	1965	Med	198	Little Change	1	Hay
	Huss	Med	9	Low Rural	539	Med	185	Some Loss	– 15	Hay
	Laona	Low	98	Med Rural	2840	Med	223	Some Loss	– 10	Hay
	Moranville	Low	15	Low Rural	1031	Med	334	Some Loss	– 15	Oats
	Nereson	Low	112	Low Rural	579	Med	123	Some Loss	18	Oats
	Palmville	Med	210	Low Rural	303	Low	38	Major Loss	– 40	Oats
	Polonia	Med	30	Low Rural	719	Med Low	96	Major Loss	– 27	Hay
	Poplar Grove	Med	209	Low Rural	434	Med	125	Some Loss	– 12	Hay
	Skagen	Low	2	Low Rural	869	Med	192	Little Change	– 1	Oats
	Stokes	None	0	Low Rural	798	Med	208	Some Loss	– 16	Oats
	Mickinock	Low	1	Low Rural	1198	Med	345	Some Loss	– 14	Oats
	SUBTOTAL B		Total Parcels		Total Value		Total Population		Average Change	
			2624		21,524		4322		– 13%	

SUB-TYPE C
Open-Forest-Cropland

Marshall	Espelie	Med	151	Low Rural	483	Med Low	88	Some Loss	– 13	Oats
	Lincoln	Low	5	Low Rural	800	Med	176	Some Loss	– 12	Oats
Roseau	Dewey	None	0	Low Rural	773	Med Low	137	Gain	24	Oats
Polk	Badger	Low	32	Low Rural	803	Med	212	Major Loss	– 25	Oats
	Gully Twp	Low	2	Low Rural	296	Med Low	77	Major Loss	– 36	Hay
	SUBTOTAL C		Total Parcels		Total Value		Total Population		Average Change	
			190		3155		690		– 0%	
	TOTAL A & B & C		Total Parcels		Total Value		Total Population		Average Change	
			4719		42,341		7762		– 15%	

Land-Type V (Forest-Marsh-Open)

This land-type is the lowest value land in the region. The majority of the forties are owned by the state or federal government. Very little of the land is cultivated; hay is the dominant crop. Population is sparse, and in 1970 only one of the organized townships contained more than 100 residents. However, on the *privately owned* portion of this land-type the population density is just as high as in other parts of the region. Overall population density is higher in other areas because there is less government ownership. Nevertheless, the land value per private forty in this land-type is the lowest in the region. It might be even lower if the public land did not, in effect, withhold so much property of similar characteristics from the market. The value of privately owned land could decrease if this public land were released for sale.

Figure 14
LAND-TYPE V
FOREST - MARSH - OPEN

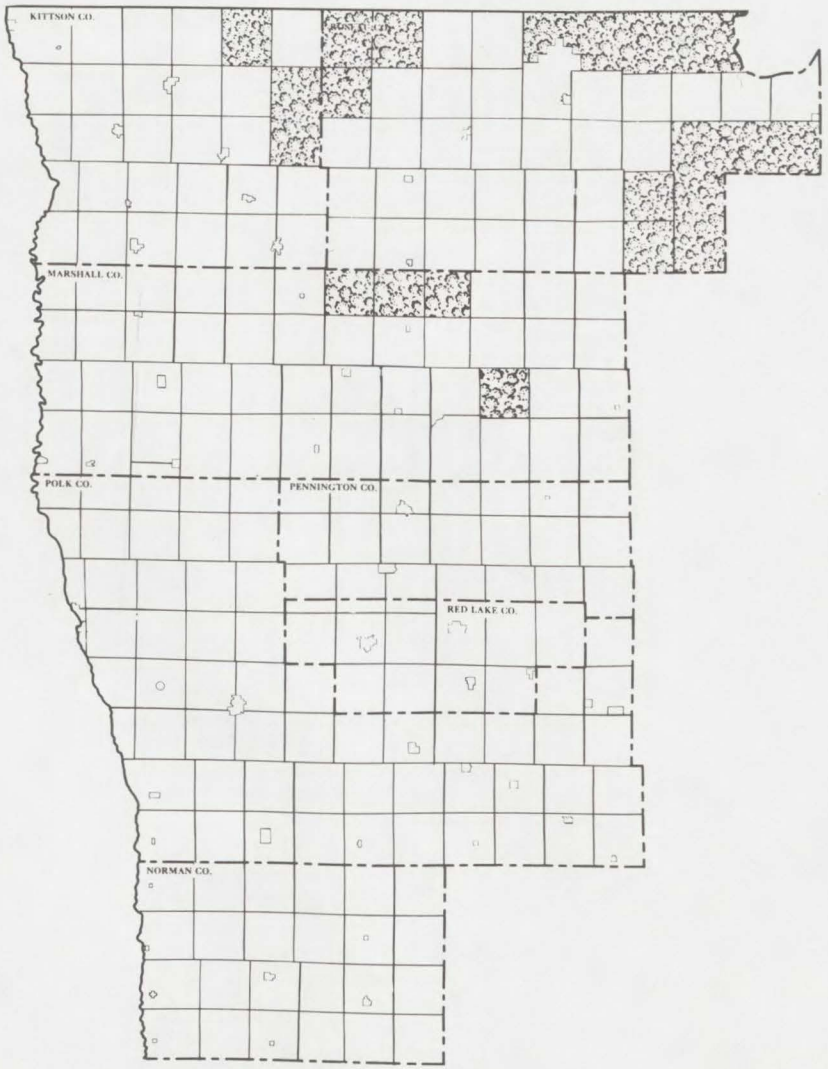


Table 12 – Land-Type V Forest-Marsh-Open

		Ownership		Value			Population			Agriculture
County	Minor Civil Division	Gov't Own. Class	No. of Gov't Owned Parcels	Land and Structure Value Class	Land and Structures Total Value (in 000's)	Pop. Density Class	1970 Population	% Population Change Class	% Change 1960-70	Dominant Crop
Kittson	McKinley	Med	152	Low Rural	322	Low	60	Some Loss	– 15	Hay
	Unorganized	Med	274	Low Rural	392	Very Low	19	Major Loss	– 51	Oats
Marshall	Como	High	319	Low Rural	248	Med	79	Little Change	1	Hay
	East Park	High	253	Low Rural	327	Low	21	Major Loss	– 50	Oats
	Huntly	High	254	Low Rural	295	Med	107	Little Change	5	Hay
	Unorganized	High	550	Low Rural	0	Med	14	Gain	27	Oats
Roseau	Beaver	High	342	Low Rural	294	Med	92	Some Loss	– 17	Oats
	Blooming Valley	High	498	Low Rural	60	Low	14	Major Loss	– 30	Hay
	Reine	Med	95	Low Rural	390	Med Low	90	Some Loss	– 20	Hay
	Unorganized	High	4602	Low Rural	2736	Med	751	Little Change	0	Hay
			Total Parcels		Total Value		Total Population		Average Change	
			7339		5064		1247		– 6%	

Land-Type VI (Urban)

This land-type constitutes only about one percent of the region's area, but it contains the majority of the population. It includes all of the municipalities. The region's assessed valuation also is concentrated here.

Figure 15
LAND-TYPE VI
URBAN

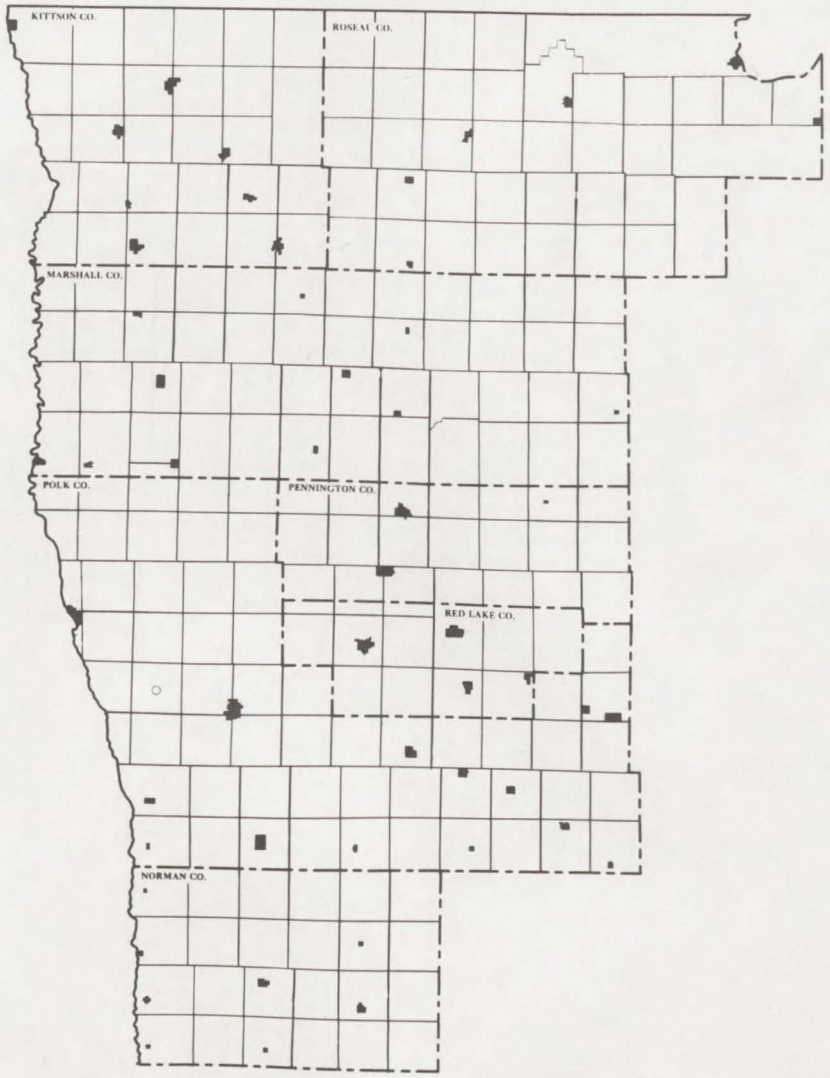


Table 13 – Land-Type VI Urban

		Ownership		Value			Population			Agriculture
County	Minor Civil Division	Gov't Own. Class	No. of Gov't Owned Parcels	Land and Structure Value Class	Land and Structures Total Value (in 000's)	Pop. Density Class	1970 Population	% Population Change Class	% Change 1960-70	Dominant Crop
Kittson	Donaldson	None	0	Low Urban	141	High	69	Little Change	8	Barley
	Hallock Village	Low	1	High Urban	5288	Very High	1477	Little Change	– 3	Wheat
	Halma	None	0	Low Urban	134	High	96	Some Loss	– 16	Oats
	Humboldt	None	0	High Urban	277	Very High	112	Major Loss	– 34	Wheat
	Karlstad	None	0	High Urban	5431	Very High	727	Little Change	1	Oats
	Kennedy	None	0	High Urban	1011	Very High	424	Little Change	– 7	Wheat
	Lake Bronson	Low	1	High Urban	618	Very High	325	Some Loss	– 23	Hay
	Lancaster	None	0	Low Urban	783	High	382	Some Loss	– 17	Hay
	St. Vincent Vil.	None	0	Low Urban	399	High	177	Some Loss	– 18	Wheat
Marshall	Alvarado	None	0	High Urban	590	Very High	302	Little Change	7	Wheat
	Argyle	None	0	High Urban	1437	Very High	739	Little Change	– 6	Wheat
	Grygla	Low	1	High Urban	188	Very High	211	Gain	10	Hay
	Holt Village	None	0	High Rural	114	High	97	Some Loss	– 15	Hay
	Middle River Vil.	None	0	High Urban	666	Very High	369	Some Loss	– 11	Hay
	New Folden Vil.	None	0	High Urban	646	Very High	390	Little Change	5	Oats
	Oslo	None	0	High Urban	1135	Very High	417	Gain	12	Wheat
	Stephen	None	0	High Urban	3036	Very High	904	Little Change	5	Wheat
	Strandquist	None	0	High Urban	123	Very High	138	Some Loss	– 14	Oats
	Viking Village	None	0	Low Urban	154	High	118	Little Change	– 8	Oats
	Warren	None	0	High Urban	6118	Very High	1999	Little Change	0	Wheat
Norman	Ada	Low	1	High Urban	7188	Very High	2076	Little Change	1	Barley
	Borup	None	0	High Urban	150	Very High	128	Some Loss	– 12	Oats
	Gary	None	0	High Urban	488	Very High	265	Little Change	1	Oats
	Halstad Village	None	0	High Urban	1554	Very High	598	Little Change	– 6	Oats
	Hendrum Village	None	0	High Urban	725	Very High	311	Little Change	2	Barley
	Perley	None	0	High Rural	242	Very High	149	Some Loss	– 10	Wheat
	Shelly Village	None	0	High Urban	832	Very High	260	Some Loss	– 16	Wheat
	Twin Valley	None	0	High Urban	1914	Very High	868	Little Change	3	Oats
Pennington	Goodridge Village	None	0	Low Urban	101	Very High	144	Little Change	7	Oats
	St. Hilaire	None	0	Low Urban	338	High	337	Gain	25	Oats
	Thief River Falls	Low	4	High Urban	24090	Very High	8618	Gain	20	Oats
Polk	Beltrami	None	0	Low Urban	676	High	171	Little Change	– 8	Barley
	Climax	Low	1	High Urban	765	Very High	255	Some Loss	– 18	Barley
	Crookston City	Low	1	High Urban	30367	Very High	8312	Little Change	– 3	Barley
	East Grand Forks	None	0	High Urban	28839	Very High	7607	Little Change	9	Barley
	Erskine	None	0	High Urban	1362	Very High	571	Little Change	– 7	Oats
	Fertile	None	0	High Urban	2707	Very High	955	Little Change	– 1	Oats
	Fosston	None	0	High Urban	7443	Very High	1684	Little Change	– 1	Oats
	Gully Village	Low	2	Low Urban	538	High	96	Major Loss	– 43	Hay
	Lengby	None	0	High Urban	287	Very High	140	Some Loss	– 23	Hay
	McIntosh	None	0	High Urban	1674	Very High	753	Little Change	– 4	Oats
	Mentor	Low	1	Low Urban	334	High	236	Some Loss	– 16	Hay
	Nielsville	None	0	High Urban	489	Very High	156	Some Loss	– 15	Wheat
	Trail	None	0	High Rural	115	High	99	Little Change	– 1	Hay
	Winger Village	None	0	High Urban	661	Very High	228	Some Loss	– 22	Oats
Red Lake	Brooks	None	0	Low Urban	243	High	163	Gain	10	Wheat
	Oklee	None	0	High Urban	1260	Very High	536	Little Change	1	Oats
	Plummer	None	0	Low Urban	530	High	285	Little Change	1	Hay
	Red Lake Falls Cy	None	0	High Urban	3878	Very High	1740	Gain	14	Barley
Roseau	Badger	None	0	High Urban	905	Very High	327	Little Change	– 3	Oats
	Greenbush	None	0	High Urban	1671	Very High	787	Gain	11	Oats
	Roosevelt	None	0	Low Urban	141	High	104	Major Loss	– 28	Barley
	Roseau	Low	1	High Urban	7474	Very High	2552	Gain	19	Oats
	Strathcona	None	0	Med Rural	25	High	31	Major Loss	– 52	Oats
	Warroad	Low	1	High Urban	2779	Very High	1086	Some Loss	– 17	Hay
			Total Parcels		Total Value		Total Population		Average Change	
			15		161,074		52101		2%	

Summary

This consideration of the present resource pattern suggests several observations and questions:

- Current urban development is concentrating at high amenity sites and probably will continue to do so in the future.
- The low land values in areas of substantial public ownership might be even lower if the public agencies were to make their land available for sale.
- Many minor civil divisions have very small populations. Should there be a minimum population size for organized units of government?
- Should there be a management plan for the beach ridges of Lake Agassiz? Do we need to preserve them for future use of their gravel deposits or for upland prairie wildlife areas?

It is clear that a wide array of regional comparisons and insights can be drawn from data now collected by various government units. The data can be valuable for resource management and development decisions, and for improved understanding of current problems. Its utility depends upon continuing efforts to make the data compatible and to keep it current.

Chapter IV

MAN'S IMPACT ON THE VIRGIN LANDSCAPE

Northwestern Minnesota was opened by western man in the 1870s and 1880s. It was a poorly drained area, with wet prairie on the western fringes and a forested zone in the northern and eastern portions. (Figure 18, Pre-Settlement Distribution of Marsh, and Figure 21, Pre-Settlement Distribution of Forest.) In addition to the wetlands still encircling central and western Roseau County, marsh originally existed in western Norman and southwestern Polk counties and on the North Dakota border where Kittson and Marshall counties touch (Figure 16).

The prairie soils were fertile, but drainage was necessary before they could be cultivated. A soil surveyor (1906) of the northern wet prairies characterized the soil (Fargo loam) that dominates the area this way:

> "As a whole the drainage of this type is very poor. The narrow strips of land bordering the larger streams and coulees are usually fairly well drained, but artificial drainage is necessary on the greater proportion of the level areas, in order to obtain profitable yields from the crops grown."[2]

Swedish, Norwegian, and French-Canadian immigrants predominated among the pioneer settlers of the region. No one of the groups represented a majority in any township except in Norman, Kittson and western Polk counties and in the vicinity of Red Lake Falls (Figure 17). The "frontier," as defined by at least 30 percent of a county's land in cultivation, advanced across the region between 1900 and 1954 and has wavered or retreated slightly since then.

[1] The principal researcher for this chapter was Steven Prestin, Department of Geography.

[2] Leslie Hewes, "The Northern Wet Prairie of the United States: Nature, Sources of Information, and Extent," *Annals of the Association of American Geographers,* Vol. 41, page 307.

The Marschner Map of Vegetation Cover at the Time of First Land Survey

An understanding of man's impact on this region can be attained by comparing present records with older observations of the region's vegetation. In the 1930s James Marschner compiled a detailed map of vegetative cover from the field notes of original federal land surveyors in Minnesota. They worked in the area mainly during the 1870s and 1880s, but as early as 1871 and as late as 1905 in Roseau County. The surveyors took notes on the types of vegetation they could observe from each section corner in a township.[3]

Of Marschner's categories, prairie grassland was the dominant original vegetation. Prairie was found in at least 213 townships and constituted 90 percent or more of the area in 47 of those townships. No other vegetation category matches this. Other categories found in substantial amounts were wet prairie, brush prairie, aspen oakland and river bottom.

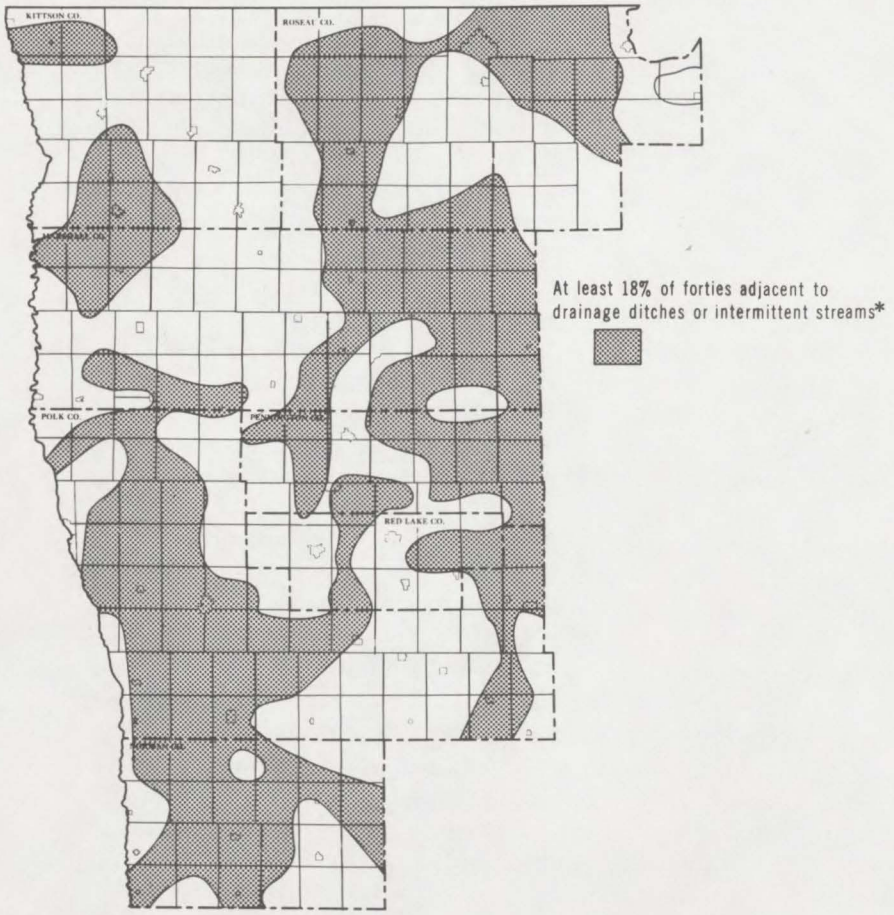
The townships containing mainly well-drained prairie were the easiest to settle and to begin farming. Here, there was no need to clear forests or drain wetlands before cultivation.

To compare original and present vegetation and land use, MLMIS and Marschner categories were combined into a single new classification (Table 15).

The following maps summarize the changes in landscape since the original survey. Only "open water" is not included. That type of surface occurs in rather small quantities in the region, mostly in the public wildlife management areas (Mud Lake and Thief Lake) and in the moraine lake region of Polk County (Maple Lake).

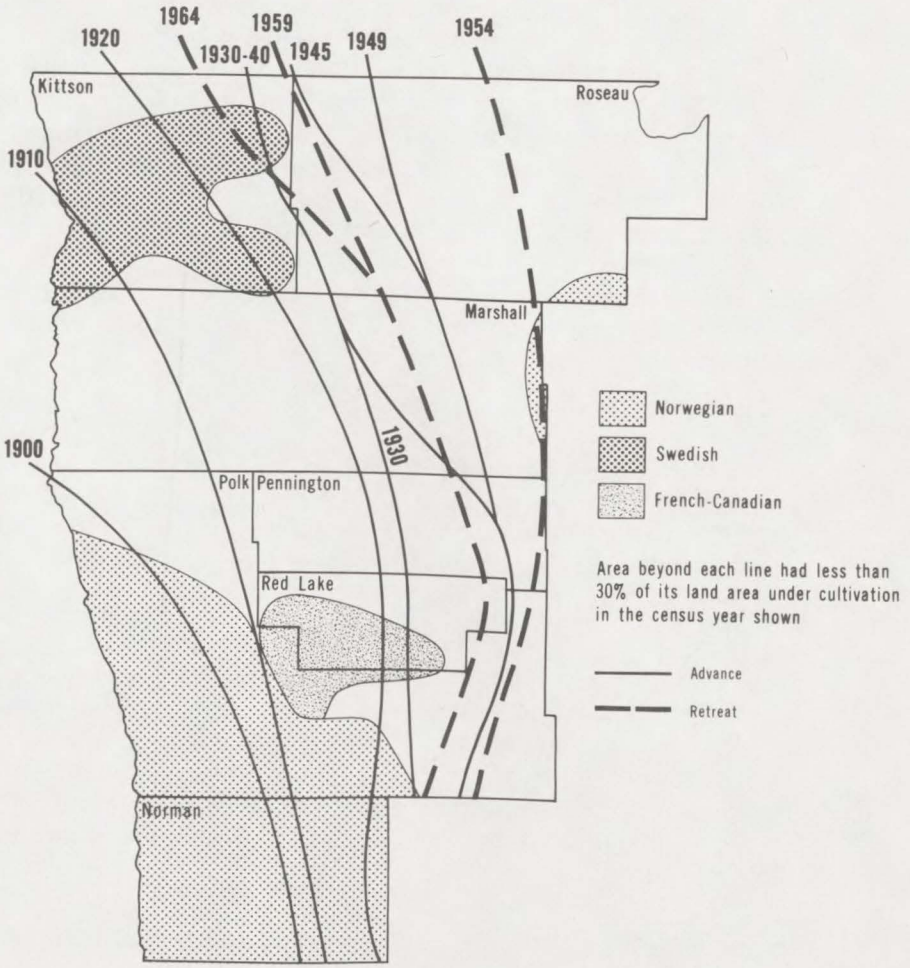
[3] A 25-dot matrix was laid over each township in the Marschner Manuscript Map. The type of vegetation at the position of each of the 25-dots and percent of all dots overlying each vegetation type was calculated. For example, if three dots in a township fell into the brush prairie category, 12 percent of the township (3 x 4 percent) was assigned to that vegetation category. These township percentages were then coded and incorporated into the data file.

Figure 16
PRESENT AREAS OF INTENSIVE DRAINAGE



*Most of these in N.W. Minnesota are drainage ditches and not intermittent streams.

Figure 17
ADVANCE AND RETREAT OF THE FRONTIER CULTIVATION AND ETHNIC CONCENTRATIONS



John R. Borchert, Donald P. Yaeger, *Atlas of Minnesota Resources and Settlement*, Minneapolis, University of Minnesota, Minnesota State Planning Agency, 1968.

Table 14 — Marschner's Original Land Use Categories

Type	Number of Townships with Type Present	Number of Townships Greater than 25% this Type	Number of Townships Greater than 90% this Type
Prairie	213	168	47
Wet Prairie Marsh and Slough	172	66	2
Open Muskeg and Floating Bog	13	5	0
Open Water	7	0	0
Brush Prairie	132	62	0
Aspen-Oakland	80	23	0
Oak Openings and Barrens	20	4	0
River Bottom Forest	70	17	4
Aspen-Birch	5	0	0
Aspen-Birch (Some Conifer)	39	21	0
Jack Pine Barrens and Openings	16	5	0
Swamp Cedar	47	24	0
Balsam and Tamarack	34	2	0

Table 15 — Classes used to compare MLMIS and Marschner Surveys of Land Cover

Combined Classification	Present (MLMIS)	Pre-Settlement (Marschner)
Wetlands	Marsh	wet prairie marsh and slough; open muskeg and floating bog
Forest	Forested	brush prairie aspen oakland oak openings and barrens river bottom forest aspen birch aspen birch (conifers) jack pine barrens and openings swamp cedar balsam and tamarack
Open & Grassland	Pasture & Open	prairie
Man's Impact	Cultivated Residential Extractive Mixed urban development Transportation	none
Open Water	Water	open water

CHANGES IN LANDSCAPE

Draining wetlands, clearing forests, developing agriculture and building cities are among man's activities that have altered the original landscape of Development Region 1.

Decrease of Marshland

In the series of maps and tables, some of these alterations can be studied. Originally, large wetland concentrations existed in two areas: (1) the wet prairies of western Kittson, Marshall, Polk and Norman counties and (2) the western fringe of the Big Bog, primarily in northern Roseau and eastern Marshall, Red Lake, Pennington and Polk counties (Figure 18). The only marsh concentrations now surviving (Figure 19) encircle central and western Roseau County. Drainage ventures were substantial in the remainder of the original marsh or wet prairie areas (Figure 16). In fact, 18 percent of the forties in Polk County and 21.5 percent of them in Norman County are adjacent to drainage ditches. In the Red River Valley, drainage created profitable

farmland. But in the tier of counties to the east of the glacial beach ridges, agriculture was a failure in many cases. Some counties to the east borrowed heavily for drainage projects, which were to be financed through assessments on the benefitted agricultural property-owners. But the farmers were unable to pay their assessments, and much of the land reverted to the state in tax forfeitures. The agriculture frontier (Figure 17) is retreating in this area. Table 16 and Figure 20 summarize the changes.

Table 16 – Forties Predominately Marsh

	Pre-Settlement Marsh*	Present Marsh	Percent Change
Kittson	3,382	1,457	-57%
Marshall	6,307	1,494	-76%
Norman	2,865	25	-99%
Pennington	1,960	157	-92%
Polk	4,932	182	-96%
Red Lake	872	61	-93%
Roseau	4,280	3,561	-17%
Region 1 Totals	24,598	6,937	-71%

*The number of forties is an estimate derived from township totals.

Figure 18

PRE-SETTLEMENT DISTRIBUTION OF MARSH

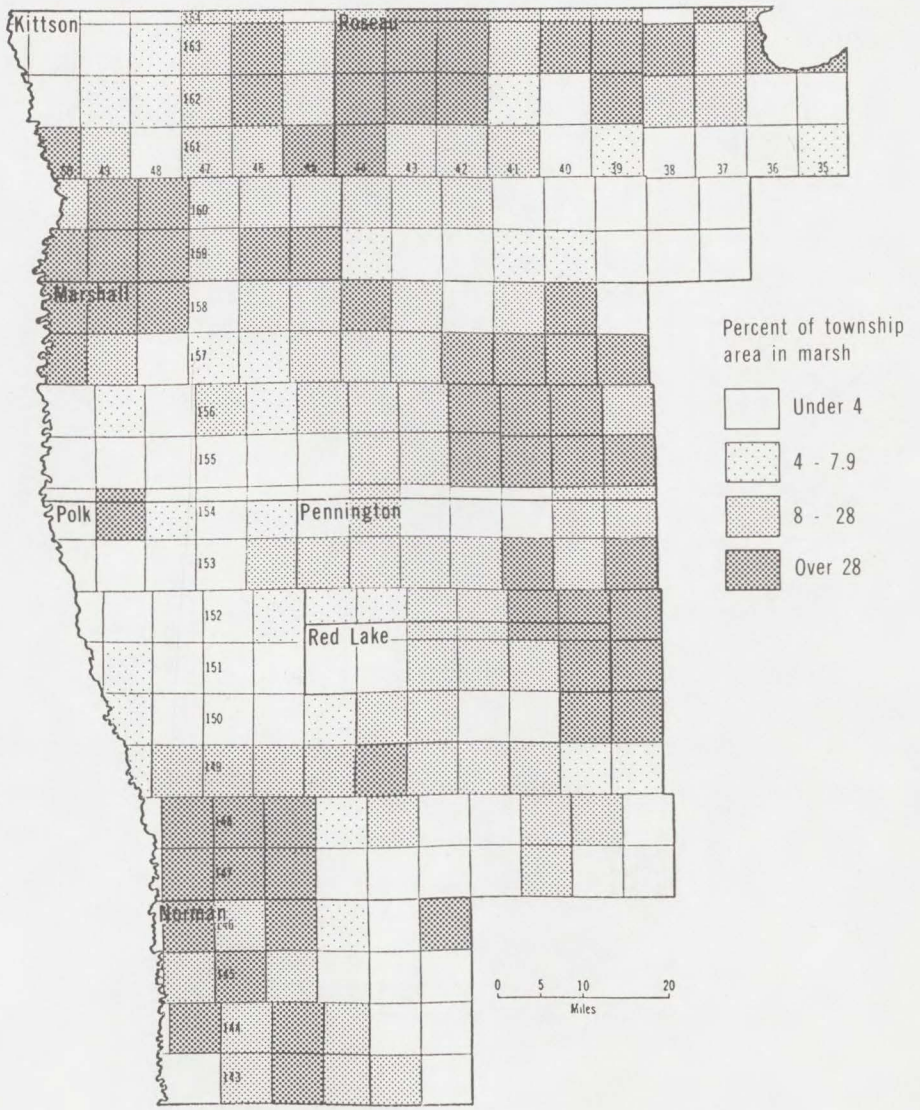


Figure 19
PRESENT DISTRIBUTION OF MARSH

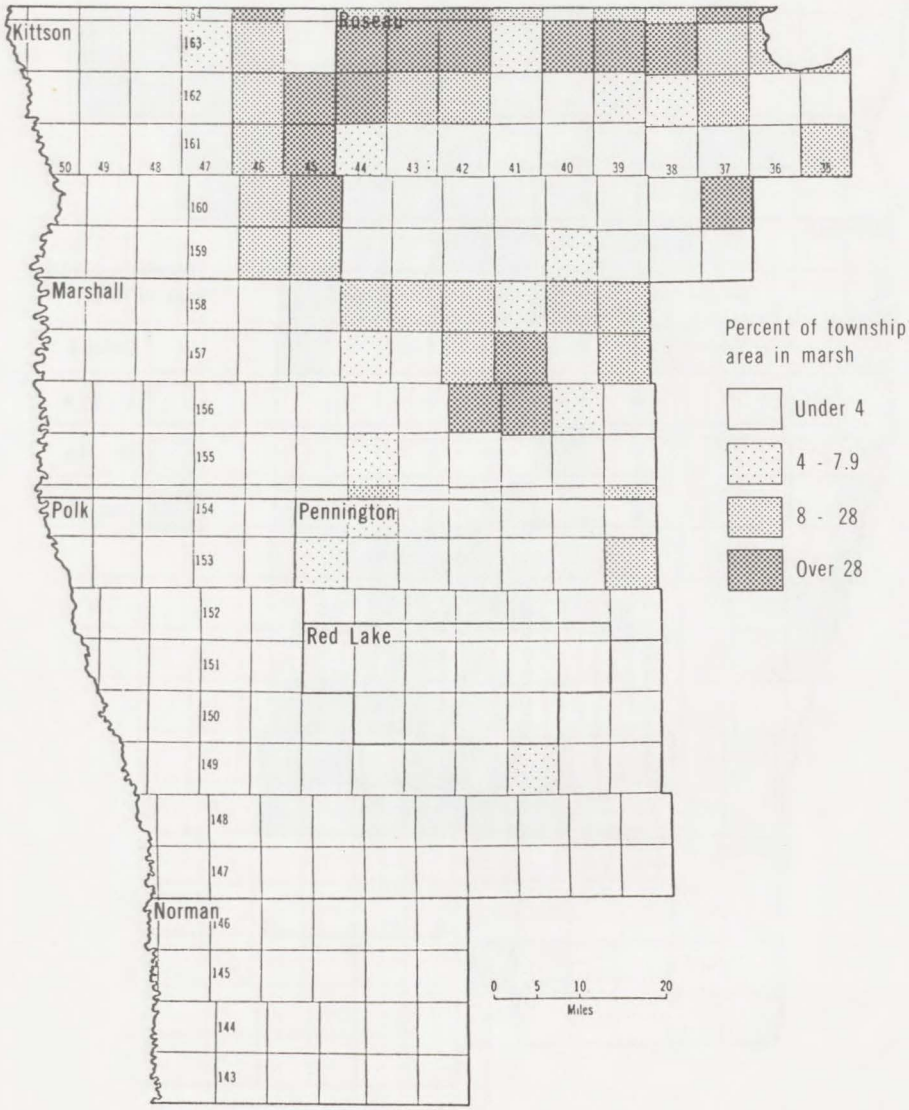
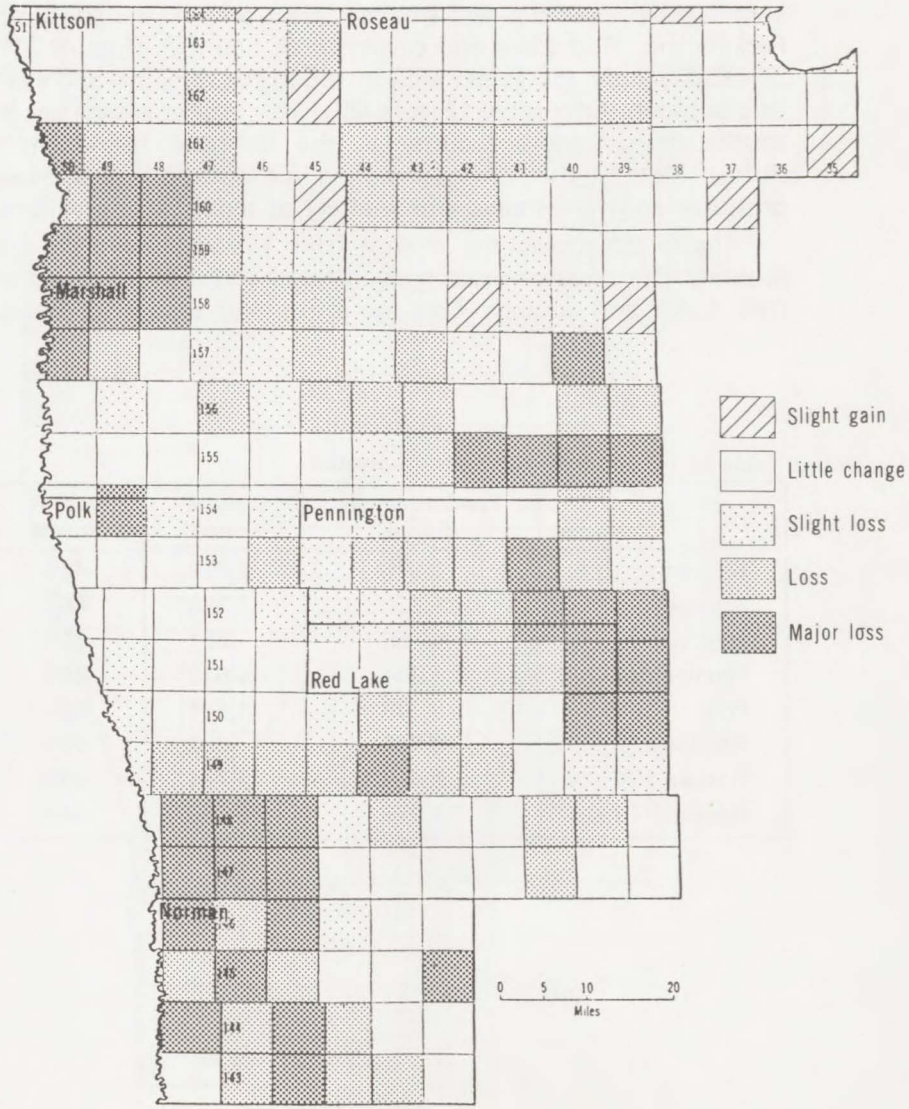


Figure 20
CHANGE IN MARSH
(Pre-Settlement to Present)



Decrease of Forest Area

Forested acreage in Development Region 1 also decreased substantially during the years of agricultural development. Marschner showed the largest forest concentration in Roseau and Marshall counties and smaller forest area to the south, in Pennington, Red Lake and eastern Polk counties (Figure 21).

Today only the forest area in the north remains, and even this is much diminished (Figure 22). The largest stands are in southeastern Roseau County in the Beltrami Island State Forest. Most of the forest remaining in the south is near lakes, potholes and farmsteads (for shelter) or along stream valleys.

Figure 23 shows the change from pre-settlement to the present. The areas of most concentrated forest clearing are in Red Lake and eastern Polk counties and east of Roseau.

Table 17 — Forties Predominately Forested

	Pre-Settlement Forest	Present Forest	Percent Change
Kittson	3,322	1,698	-49%
Marshall	9,730	3,328	-66%
Norman	1,785	651	-64%
Pennington	4,064	639	-84%
Polk	9,190	1,627	-82%
Red Lake	3,486	683	-80%
Roseau	19,472	7,734	-60%
Region 1 Totals	51,049	16,360	-68%

Figure 21

PRE-SETTLEMENT DISTRIBUTION OF FOREST

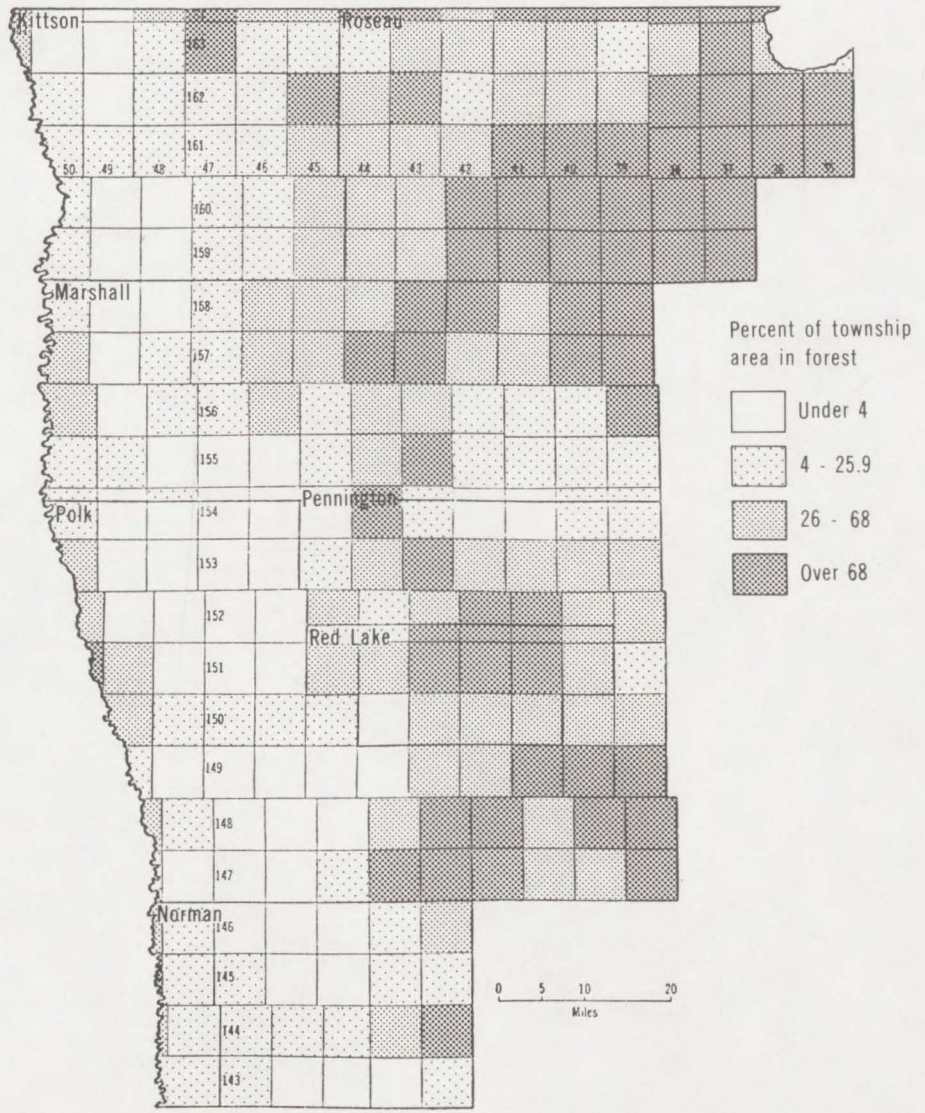


Figure 22
PRESENT DISTRIBUTION OF FOREST

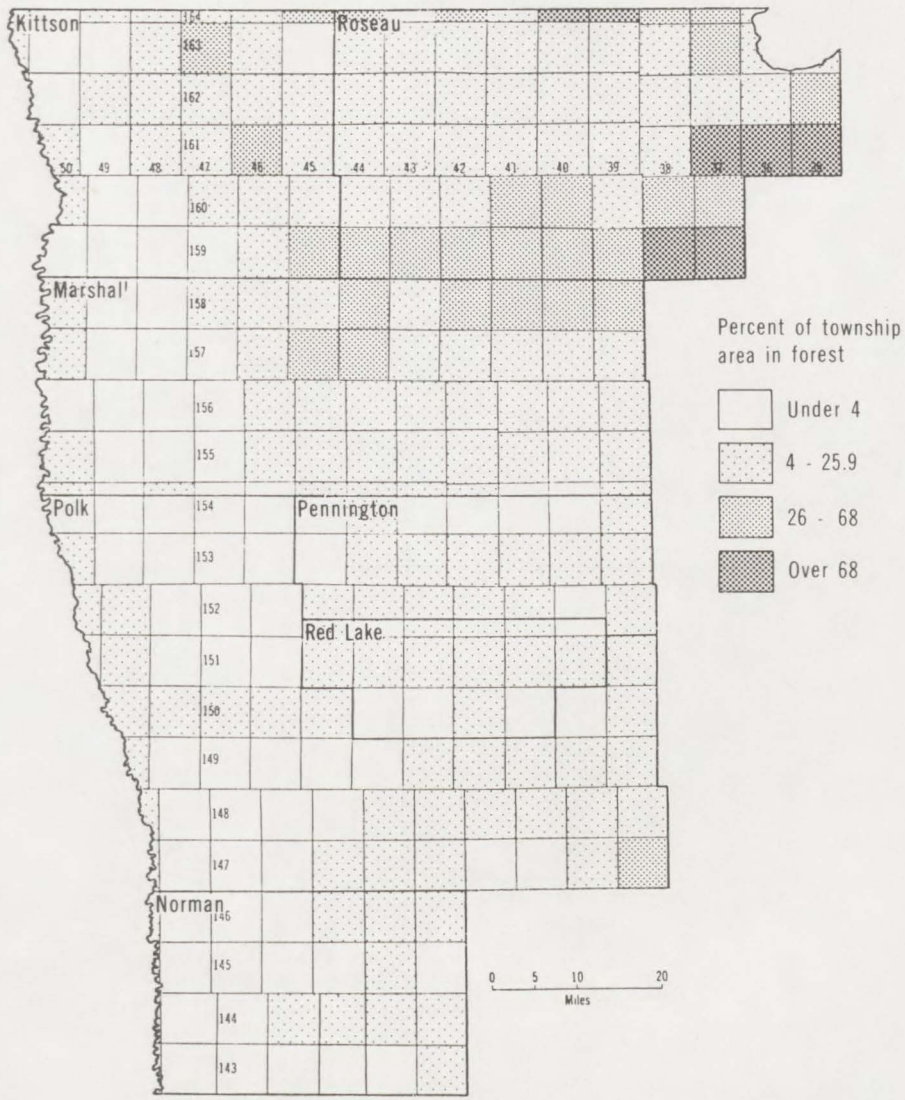
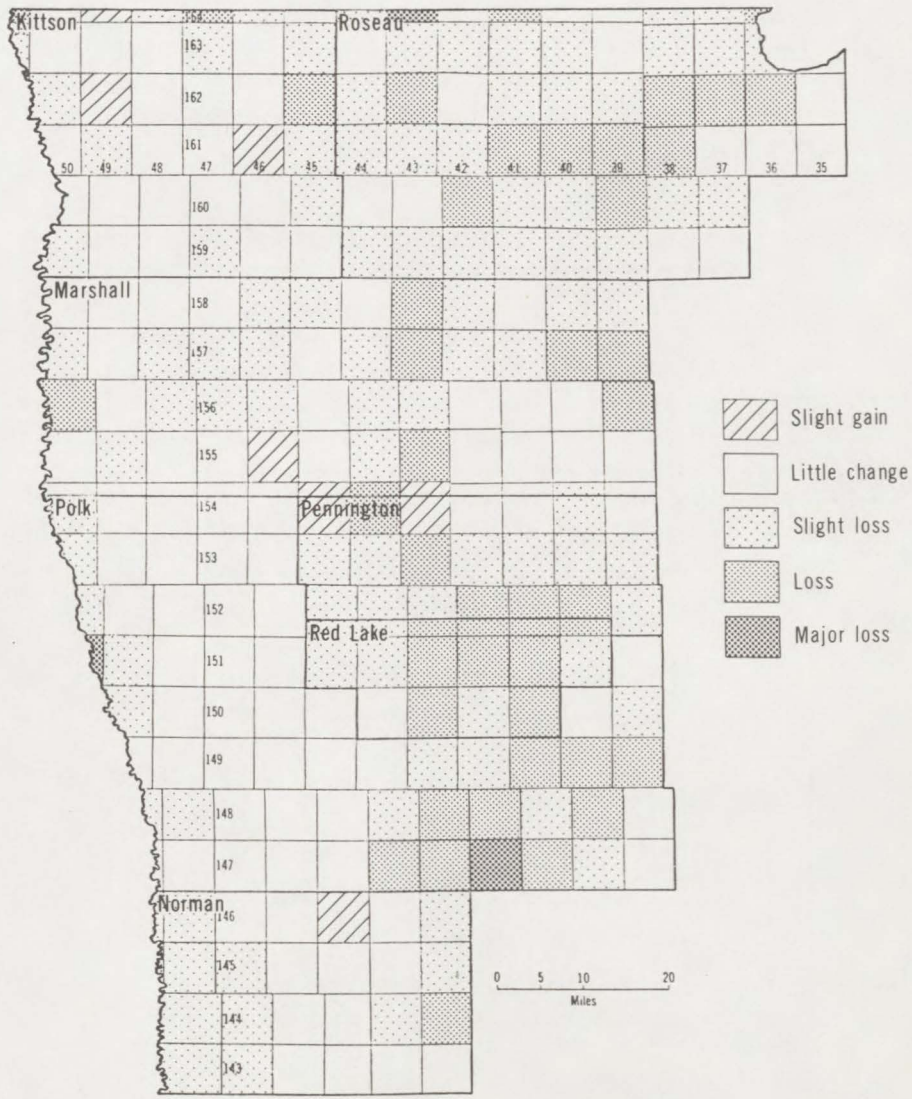


Figure 23
CHANGE IN FOREST
(Pre-Settlement to Present)



Decrease of Natural Grassland (Prairie)

When the early European settlers entered this region of Minnesota, they found vast areas of grass or open land, much of it poorly drained. Two marshland zones near the Red River were included in Marschner's wet prairie marsh or slough classification (Figure 18); however, a large portion of the grasslands had better drainage (Figure 24). Nearly all of the prairie land occurred in the western half of the region in the basin of glacial Lake Agassiz. Only a small island of grassland lay farther toward the east, along the Marshall-Pennington county border.

Like forest and marsh, the distribution of grassland and open land was altered as the region developed. The change in this pattern is impressive. Today, the former wild prairie grasslands of the Red River Valley are almost completely under cultivation (Figures 25 and 26). In the northeastern part of the region, "open" land has actually shown a net increase (Table 18). But most of the original prairie is now cultivated; meanwhile, today's "open" lands tend to be the result of forest clearing and wetland drainage. Many of these areas are marginal economically and are now used for pasture or lie idle, even though at one time they may have been cultivated.

Table 18 – Forties Predominately Grassland

	Pre-Settlement Grassland	Present Grassland	Percent Change
Kittson	11,127	2,538	-77%
Marshall	12,614	4,468	-62%
Norman	9,417	506	-94%
Pennington	3,829	941	-75%
Polk	17,920	1,603	-91%
Red Lake	2,553	454	-82%
Roseau	3,314	3,889	+2%
Region 1 Totals	60,774	14,399	-76%

Figure 24

PRE-SETTLEMENT DISTRIBUTION OF GRASSLAND

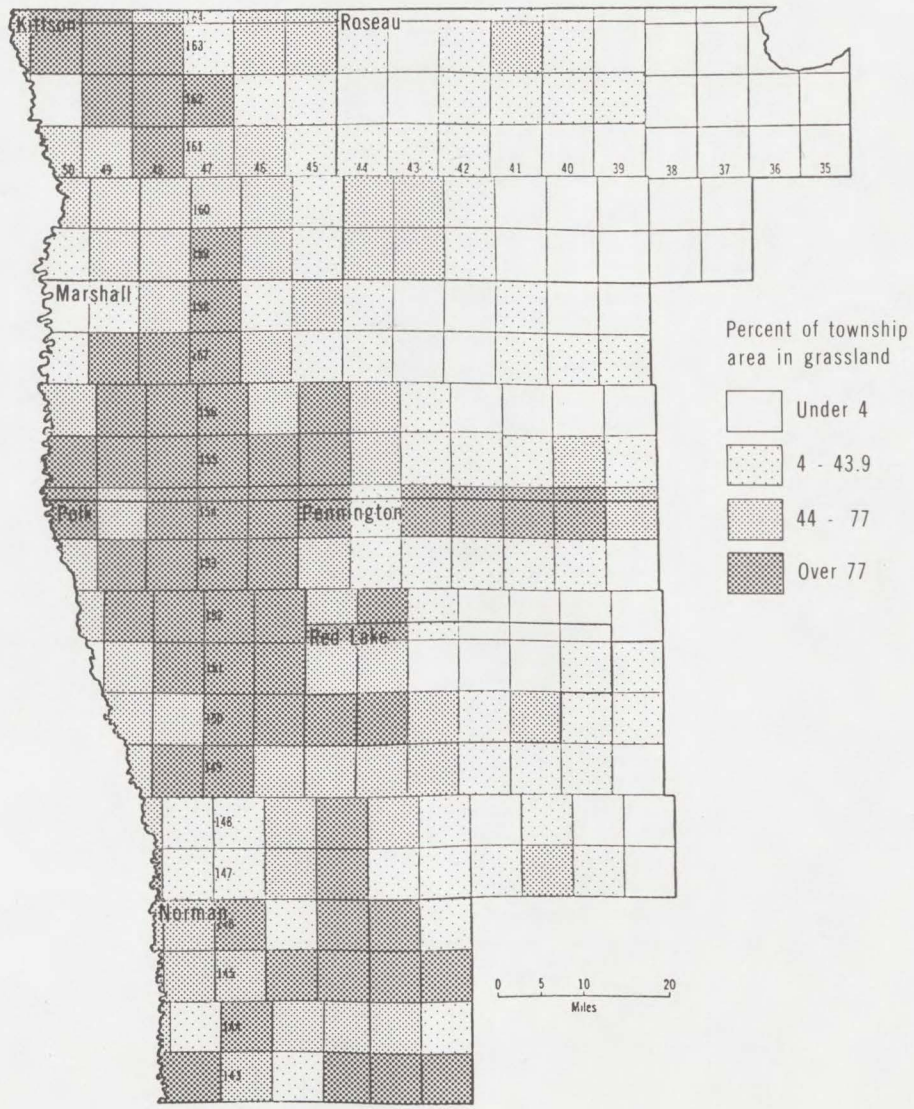


Figure 25
PRESENT DISTRIBUTION OF GRASSLAND

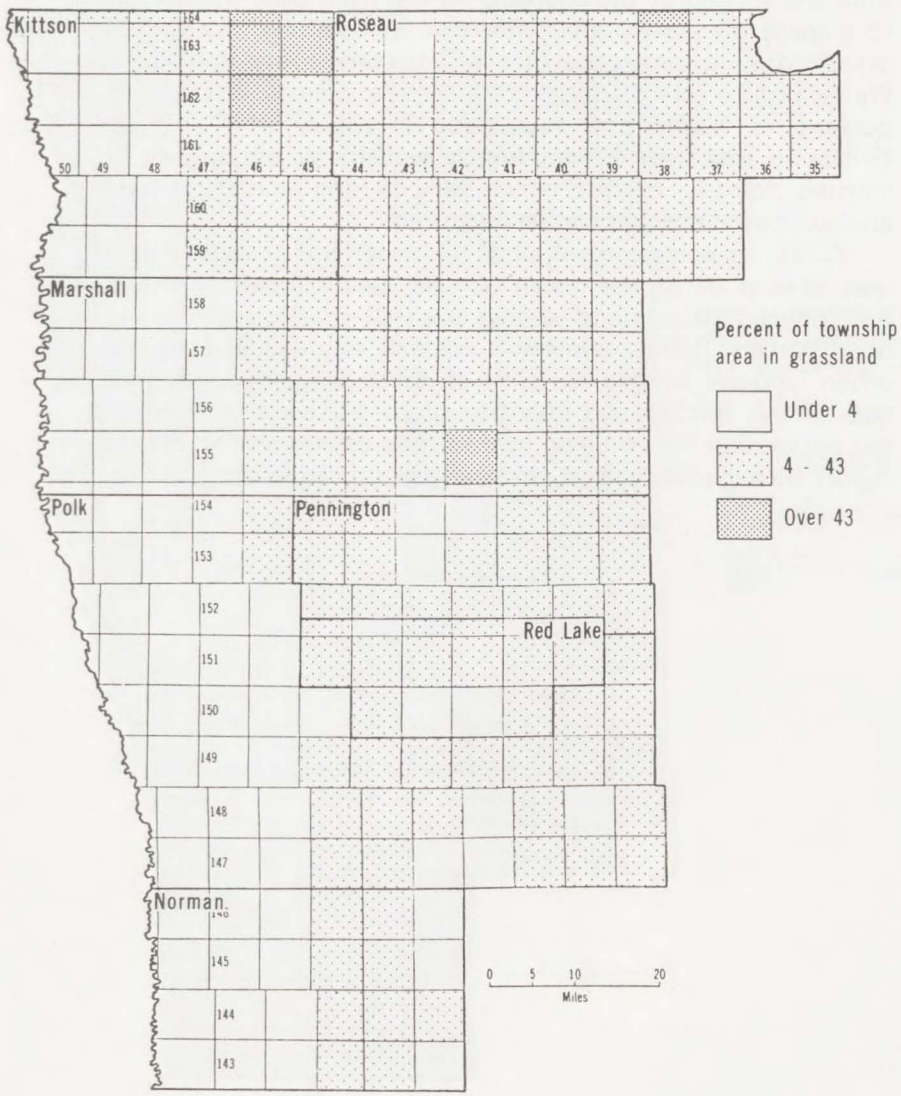
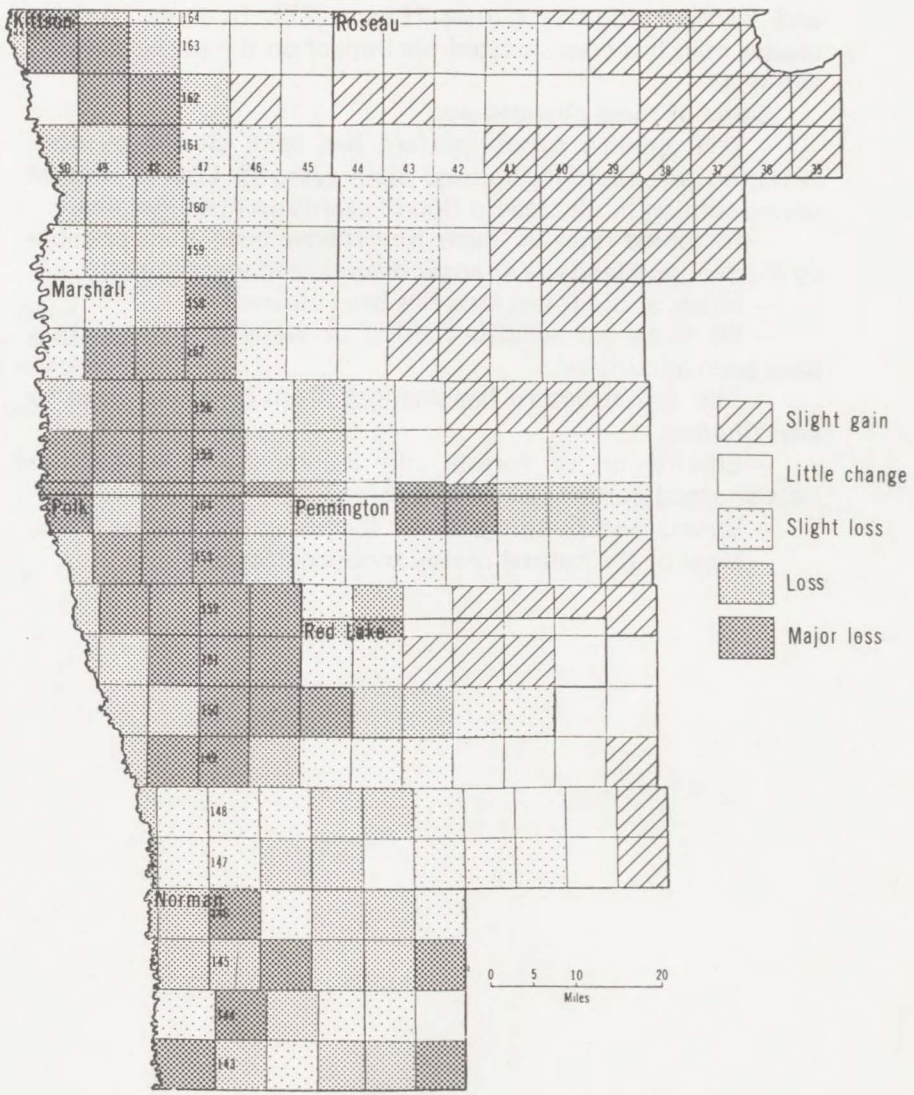


Figure 26
CHANGE IN GRASSLAND
(Pre-Settlement to Present)



Composite Impact of Development

A measure of man's total impact on the land in Development Region 1 has been approximated by totaling the forties in cultivated, residential, extractive, mixed urban development and transportation land uses (Figure 27). In these land-use classes man has concentrated his impact on the pre-settlement landscape.

Some of these changes are:

– The region's runoff pattern has been altered by construction of extensive drainage ditch systems. Loss of natural impoundment has increased flood hazards on main streams.

– Increased rates of water runoff have been made possible by ditches, and land-use changes have altered water quality.

– Much of the forest land has been cleared.

– Wetlands for wildlife habitat or waterfowl production have been eliminated.

– The soil structure has changed from poorly drained to well drained.

– Elimination of forests and accompanying cultivation have changed patterns of wind erosion.

– Streets and buildings cover former grass or open lands.

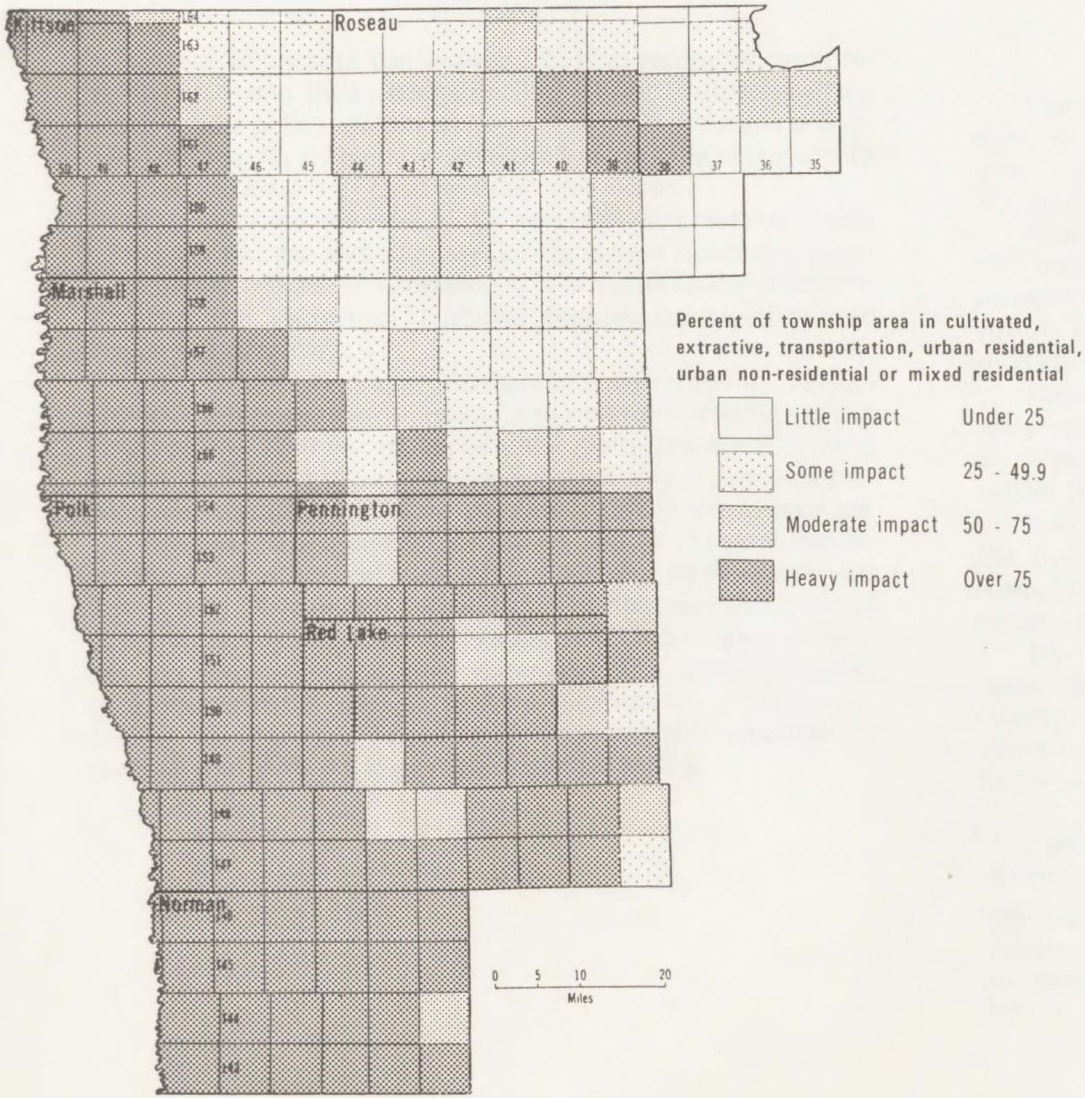
– Most of the natural prairie is now cultivated.

Thanks to the early surveyors and James Marschner's work, we have a summary record of the changes in the natural environment of this region. Human impact will continue to alter the landscape. We have inventoried this impact at two points in time and looked at the changes. As the need becomes greater to manage the state's environment more carefully, the kind of documentation presented here will become more important. We cannot be sure of our exact future data needs. But it is important to maintain a systematic inventory of man's activities so that such information is available as a baseline – a starting point – against which various long- and short-term environmental changes can be measured.

Public agencies control all of the water and extractive land uses, almost all of the marsh parcels, nearly three-fourths of the forested parcels and almost one-half of the pasture and open parcels. Public ownership is small in the cultivated and urban land-use categories. Both of these categories influence heavily the quality and quantity of runoff because most of the population lives on land in these two categories and affects runoff through farming practices and waste disposal.

Figure 27

COMPOSITE IMPACT OF DEVELOPMENT ON PRE-SETTLEMENT LAND USE



Chapter V

MANAGEMENT OF FUTURE CHANGES

Before Minnesota can manage its land resources comprehensively — and thus systematically influence future environment — state policy makers must be able both to estimate carefully the impact of land-use changes *before* they occur and to monitor the effects of changes *after* they occur.

This requires the ability to assemble information from numerous sources and summarize it to answer questions about a particular region or problem. It also requires the ability to simulate the impact of land-use changes on resource and settlement patterns.

The Minnesota Land Management Information System provides a framework for assembling and summarizing various resource and land-use data from the many sources that exist within public and private agencies. Eventually it will also provide the means to simulate the impact of land-use changes.

The two case studies that follow illustrate the potential inventory and analytical uses of the system. Both studies are centered in Development Region 1. The first seeks to respond to a hypothetical request for a summary of the status of land-use and ownership in a small watershed. The second responds to a hypothetical need to select a location for a wood processing plant which would most economically assemble its raw material with the least environmental change.

THIEF RIVER WATERSHED[1]

The MLMIS system has the potential to store and analyze data for many different types of geographic units. One such unit is a watershed; the Thief River watershed, in Beltrami, Marshall and Pennington counties, is an example.

A watershed file was created by aggregating the minor civil division files within the watershed. The files contained information on land use, public ownership, population, and stream location. This file provided a data base for the watershed study.

Maps containing the watershed streams and boundaries were obtained from the Division of Waters, Soils and Minerals, Minnesota Department of Natural Resources; Soil Conservation Service; U.S. Department of Interior. The boundaries differed somewhat on each map. An independent analysis of the hydrologic data, especially the direction of flow of the many drainage ditches in the area, established the boundaries shown in Figures 28-31.[2]

The land within the watershed yields all of the surface water discharge into the Thief River from its tributaries. The quantity of water discharged depends in part on the physical characteristics and use of the land. Land use is an important factor in determining the quality of the water runoff.

---

[1] The principal researcher of this case study was Jeff Featherstone, MLMIS staff.

[2] This information was taken from the 1967 County Highway Maps for Beltrami, Marshall, and Pennington counties. Additional information on the watershed boundary was supplied by the Minnesota Department of Natural Resources.

Physical Characteristics

Information from MLMIS was available on watershed size and amount of land adjacent to rivers, lakes and ditches (water-oriented forties).

Approximately 700,000 acres of land in western Marshall, eastern Beltrami and northern Pennington counties are drained by the Thief River system (Figures 28-31). The watershed has an exceptionally large number of drainage ditches; they checkerboard the landscape. Ditches run through, or adjacent to, nearly 30 percent (5,218) of the forties. Only one percent of the parcels are on rivers (the Moose, Thief and Mud), and four percent are adjacent to lakes (Mud and Thief). Three percent are completely submerged.

Changing Use

The watershed's pre-settlement landscape has been substantially altered by man's use of the land. This is shown by the change from the pre-settlement vegetation cover to the present land uses. Before settlement, the watershed was heavily forested in the north, marshy in the central and south portions, and largely open or grassland in the south. Although some areas have changed little since settlement, more than 2,100 forties of marsh (12 percent of the watershed) and 4,350 forties of forest (25 percent of the watershed) have been drained and logged.

When the data are summarized for townships, two dominant types of change emerge (Figure 28). The largest group of townships lost both forest and swamp land, while gaining in both cultivated and pasture and open land. The second largest group lost mainly forest while gaining in either cultivated, or pasture and open, and swamp land. The increase in swamp is probably the result of clear-cutting conifer species in wet areas.

Today's pattern of cultivated land in the basin is largely an expression of the agricultural expansion which occurred between 1890 and 1930 (Figure 29). There was extensive drainage, clearing of forests and plowing of open land. Newspaper headlines in 1910 ("Thief River Bottoms to Become a Garden", "Network of Ditches and Laterals Reclaims Vast Area in Thief River Valley", "Territory as Large as Rhode Island Changed from Swamp to Fertile Farms") proclaimed how man was changing the area into an agricultural paradise. However, by 1933 this scheme to develop an agricultural base with a 650,000-acre drainage project had fallen upon hard times. Some of the drained lands were poorly suited for crop production. Some farming efforts failed, preventing retirement of bonds issued to finance the drainage ditches.

The most common current land use is cultivated (35 percent of the forties), followed by marsh, forested, and pasture and open (Table 19). There is very little urban land (0.2 percent of the forties). Each of these land uses has different effects on the watershed runoff.

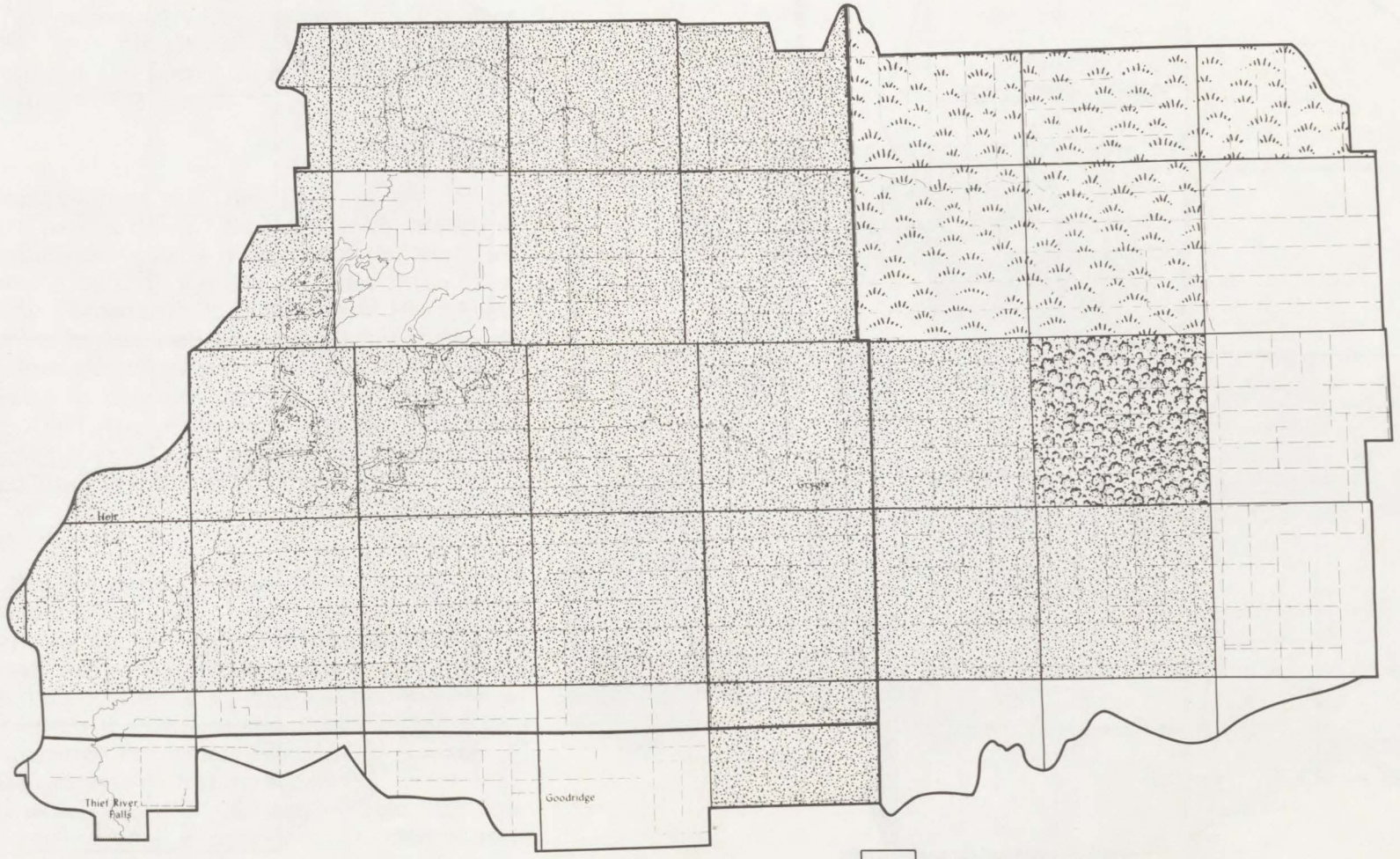
Table 19 — Land Uses of the Watershed

Land Use	Number of 40s	Percent
Cultivated	6136	35.0
Marsh	4059	23.1
Forested	3820	21.8
Pasture & Open	3089	17.6
Water	410	2.3
Urban Residential & Urban Non-residential or Mixed Residential	35	0.2
Extractive	1	0.0
Total	17550	100%

Figure 28

LAND USE CHANGE

(Pre-Settlement to Present)



Little change

Loss in Forest and Marsh
Gain in Cultivated and Pasture and Open

Gain in Forest, Cultivated, and Pasture and Open
Loss in Swamp

Loss in Forest
Gain in Cultivated, Pasture and Open, and Marsh

Figure 29
DISTRIBUTION OF CULTIVATED LAND

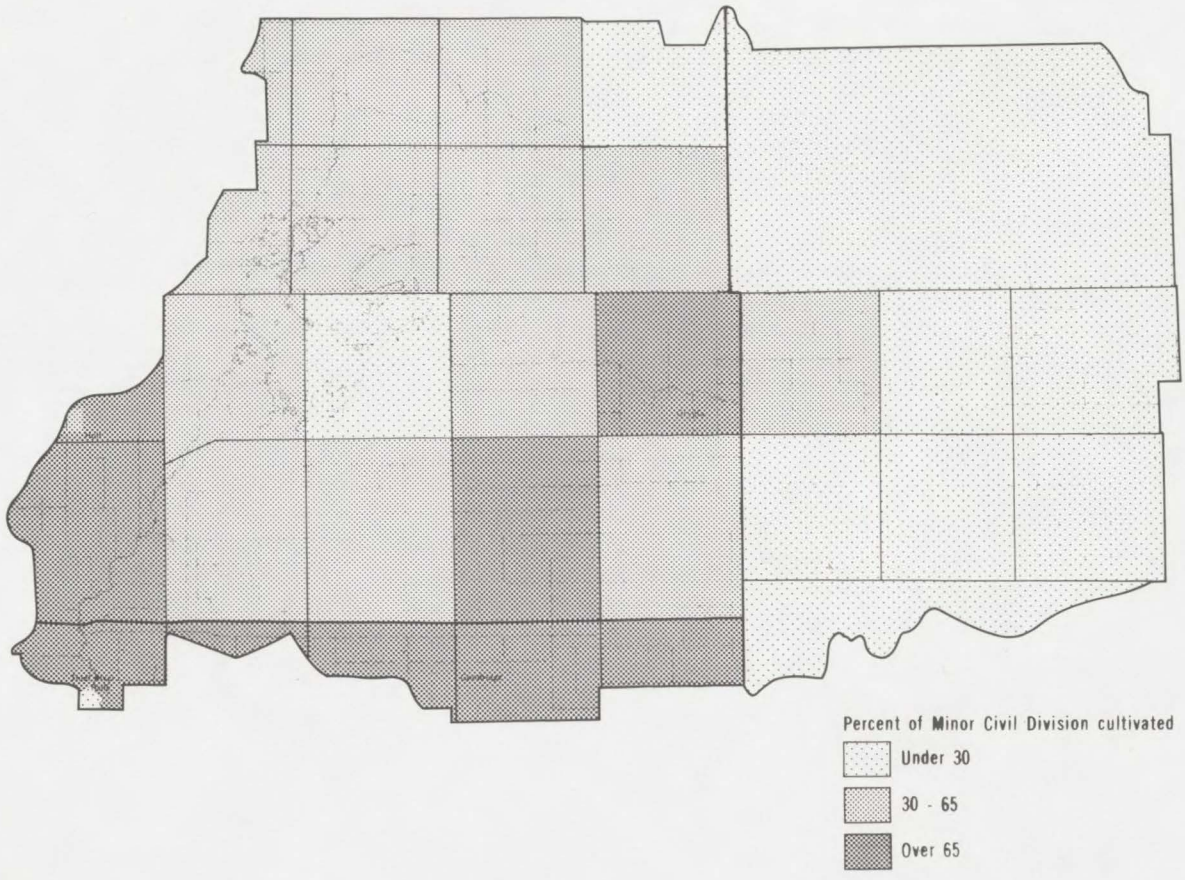
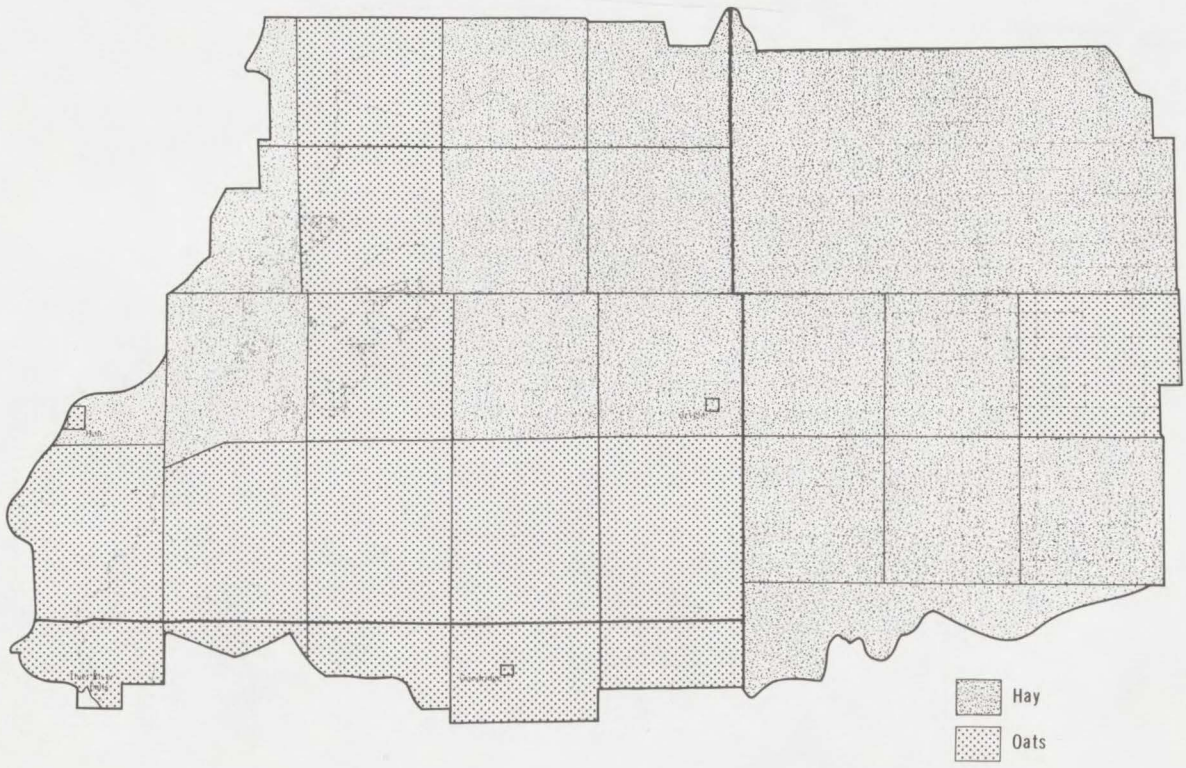


Figure 30
DOMINANT CROP OF EACH MINOR CIVIL DIVISION



Agriculture

Farming practices have their biggest impact on the southwestern part of the watershed where oats are the dominant crop (Maps 29-30). Thus, this area is likely to be the principle source of silt, fertilizer and pesticides in the discharge from the basin. It is the best drained area.

Population

The 1970 population of the Thief River watershed was estimated at 5,570 people, down 1.5 percent from 1960. The loss would be considerably greater if the population comparisons did not include part of the city of Thief River Falls, which increased by 20 percent. Outside of Thief River Falls, the watershed population has declined substantially. The population density within the watershed is low (Figure 31). Generally, the highest rural densities are near Thief River Falls, Grygla and Holt. Thief River Falls alone accounts for almost half the total population of the watershed. Thus, the potential domestic waste pollution is concentrated there.

Public Ownership

Since 1930 the watershed has experienced a decline in farming and an expansion of public land holdings, primarily in the form of large areas set aside for wildlife management. Today more than half the area is in public lands – 14 percent federal, 39 percent state. Thus, the policies of public agencies have a large impact on the amount and quality of the water runoff in the watershed. The largest individual land holder is the Minnesota Department of Natural Resources' Division of Game and Fish, with about 134,000 acres (Table 20). The watershed also contains a small amount of county land. (Exact totals will not be available until the Lands and Forestry Division land classification program is complete.)

Contrary to what one might expect, the uses of the public land are highly varied. The land uses under public ownership and the percentage of each use which is in public ownership are shown in Table 21.

Figure 31
POPULATION DENSITY

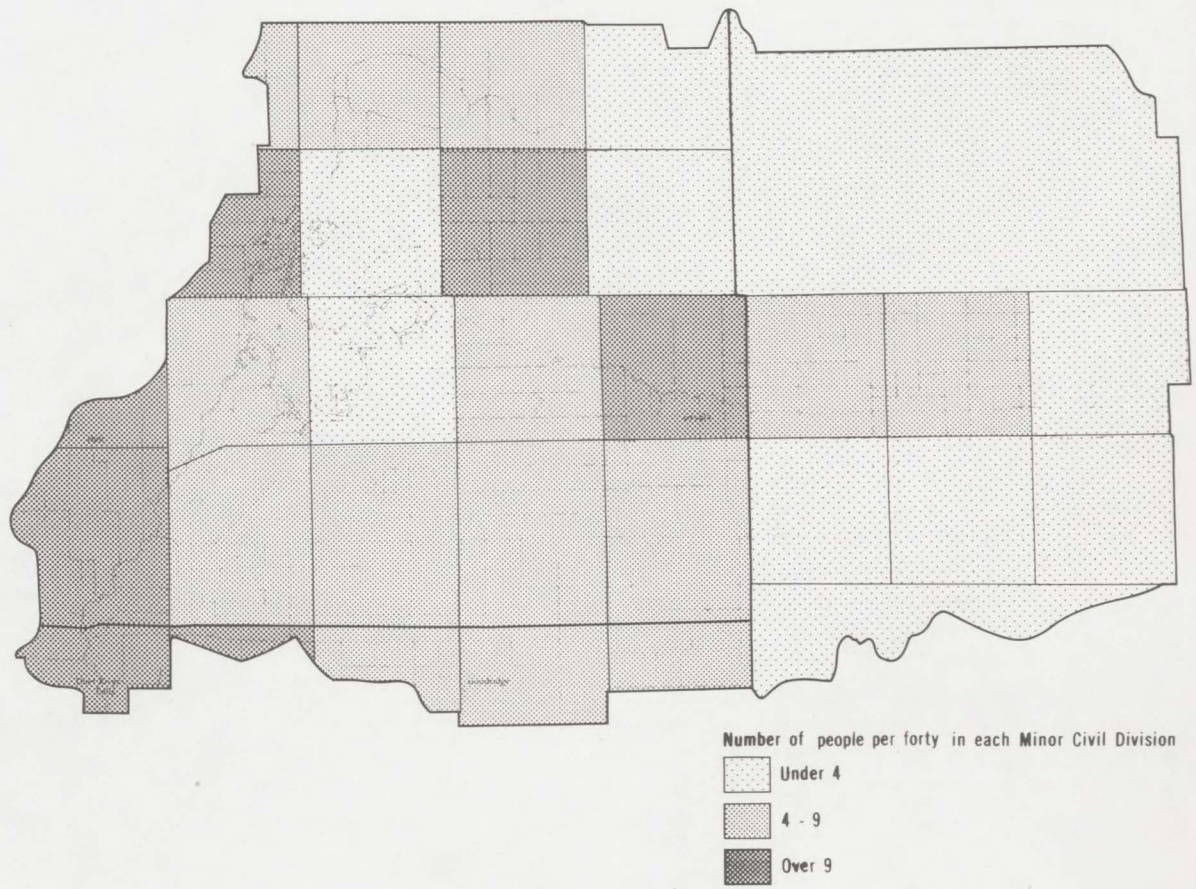


Table 20 — Acres of State and Federal Land

National Wildlife Refuge	61,000
Bureau of Indian Affairs	27,000
Department of Natural Resources Division of Game and Fish	134,000
Department of Natural Resources Division of Lands and Forestry	114,000

Table 21 — The Use of Public Land

Land Use	Number of Publicly Owned Forties* (State & Federal)	Percentage Distribution by Land Use	Percentage of All Forties in each Land Use Owned by Public
Forested	2,762	33%	72%
Cultivated	234	3%	4%
Water	244	3%	100%
Marsh	3,786	45%	93%
Urban Residential	1	-	-7%
Extractive	1	-	100%
Pasture — Open	1,399	17%	45%
Urban — Non-residential	2	-	10%
TOTAL	8,429	100%	

*It is assumed that all forties under water are owned by the state.

INDUSTRIAL LOCATION[3]

A Wood Processing Plant

Goals important to both the private and public sectors are combined in the following case study of the location for a hypothetical wood-processing plant. The best site will be the most economical and efficient for plant operation and will exert the least negative effect on the environment.

A portion of the information necessary to evaluate alternate locations can be gathered quickly by MLMIS. As in the case of the Thief River watershed study, this project obtained the information by creating a separate, new tape file. This was done by compiling data files for Minor Civil Divisions in comparable sets of concentric circles around alternate plant locacations.

This study assumed that a major wood-processing company, in conjunction with a development agency, contemplated establishing a pulp or pressed-wood processing plant in Region 1, and that Red Lake Falls, Roseau and Thief River Falls all met preliminary requirements such as a water supply of adequate quality and quantity. The three sites were examined and evaluated in order to determine the best plant location, in terms of data contained in MLMIS.

The company and agency must consider available manpower and timber resources. In addition, they must make certain environmental determinations that will affect their final decision. The plant location then will be decided by evaluating the different sites in terms of a combination of factors. The site with the combination most in keeping with both corporate and agency goals and objectives will be chosen for the plant.

[3] The principal researcher of this case study was Jack Shea, College of Forestry.

Labor Resource

The human resource potential for both the timber harvesting and plant operation procedures must be adequate. The 1970 Census was examined to see how many people lived within 6, 12, and 25 miles of the three sites.[4] At the 6 and 12 mile radii, Thief River Falls has the largest potential labor market. At 25 miles, Red Lake Falls, is largest.

Miles	Red Lake Falls	Roseau	Thief River Falls
6	2,488	3,475	10,350
12	4,947	5,162	12,108
25	33,147	10,383	21,184

A more thorough evaluation of the labor situation will be possible as 1970 Census data become more complete. The population can be examined in terms of age and sex, income, and occupational characteristics. This information can be added to the analysis because MLMIS forty data are coded geographically, not only to the U.S. Land Survey system (legal descriptions), but also to the system used by the U.S. Census. Hence, Census tapes available in the Minnesota Analysis and Planning System (MAPS) can be analyzed within the MLMIS framework, and MLMIS data can be summarized within the Census reporting framework.

Wood Resource

Next, to approximate the wood resource available, the number of parcels of forested land was calculated within 6, 12, and 25 miles of each community. The accompanying graph shows that Roseau has a tremendous advantage in the number of forested forties within the 25-mile radius. If the data are summarized by township, the advantage also accrues to the Roseau area (Figures 32 and 33). The cost of constructing access roads would be less than in the other two areas because the wood resources are available in larger concentrations.

[4] Distance limits were set only to keep radii within the Region 1 planning area. Distances could be extended up to a state wide basis, if desired, or all areas within one-half the distance to the next competing wood processing plant could be considered.

Figure 32

FOREST LAND IN EACH MINOR CIVIL DIVISION WITHIN 25 MILES OF ROSEAU, THIEF RIVER FALLS, AND RED LAKE FALLS

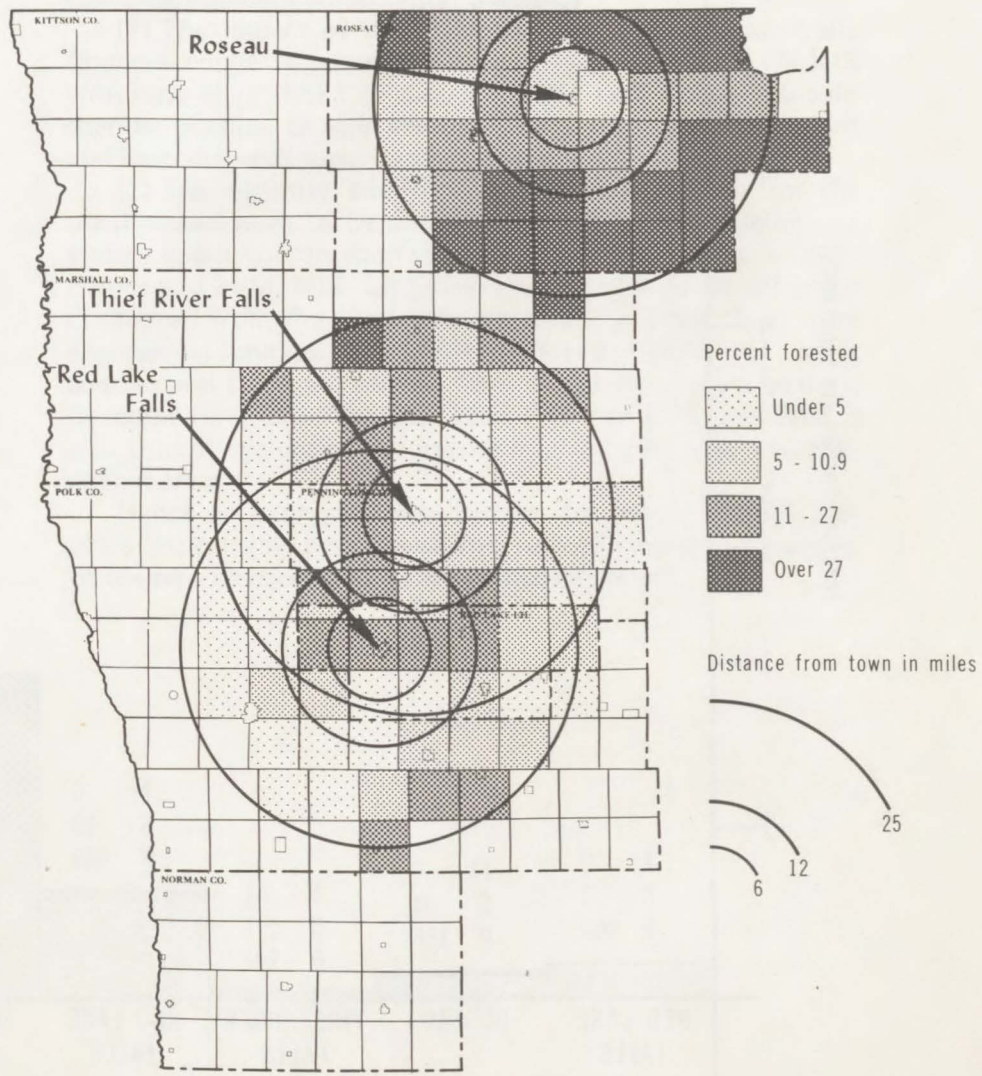
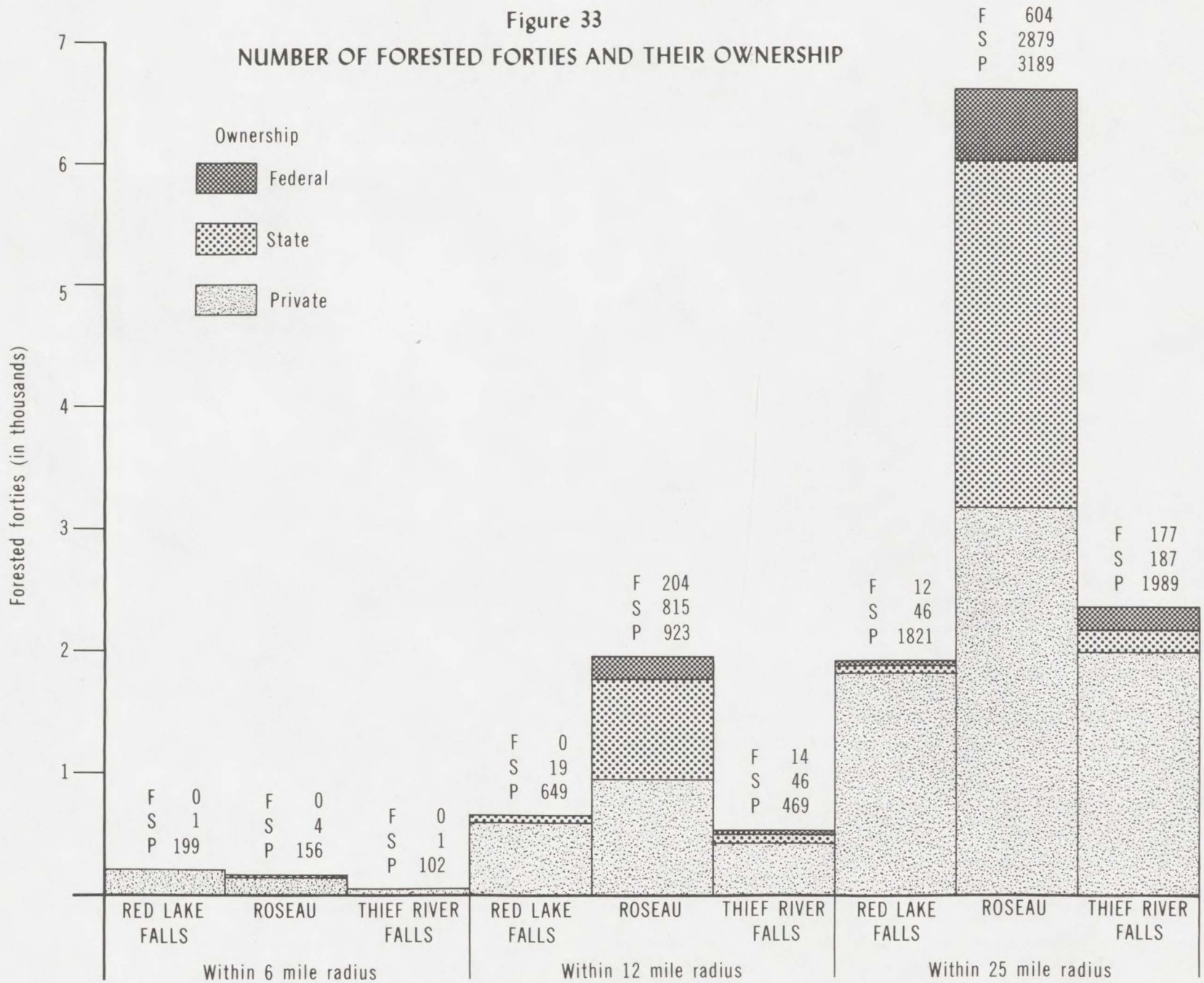


Figure 33

NUMBER OF FORESTED FORTIES AND THEIR OWNERSHIP



A different strategy could produce quite different results. The MLMIS data could be used to locate and evaluate not only existing forest land but also open, uncultivated land which could be reforested and integrated with existing forest to develop a long-term, sustained-yield forest over a large, compact part of the region.

Land ownership and management objectives on all state and county owned land, in preparation by the Department of Natural Resources, Division of Lands and Forestry, will supply further data for evaluating the timber resource. This data, when complete, will be accessible by the MLMIS framework. If the Division of Lands and Forestry's forest inventory information were integrated with MLMIS, a more concise breakdown of timber characteristics of state-owned land could be made and evaluated.

Exploitation of the forest resource would have an impact which could be evaluated with the help of MLMIS data. The effect of changed rates of water infiltration or runoff could be estimated for specific areas to be logged, taking into account local soils and spacing of streams. Needs for buffer zones could be anticipated and the zones located on the basis of land-use information. Adverse effects on the watershed could be minimized.

Need for Additional Data

Two major considerations would require merging MLMIS data with other information systems or adding data to the Land Management Information System.

(1) The impact of the plant on local and regional public finances could be assessed by combining data from MLMIS with data from RAFT (Rapid Analysis Fiscal Tool). It would then be possible to estimate the local tax impact of the plant and its new use of forest land in the region.

(2) The quantity and quality of water available for the plant would have to be determined from stream gauging and stream quality observation stations. These data are not now incorporated in MLMIS. Likewise, amount and quality of water discharged from the plant would have to be determined from engineering studies. But planning for protection of water sources and storage upstream from the plant can best be done by combining data on water resources and land use. That is also true of evaluating the impact of plant discharge on downstream areas.

Hence an expanded data system, for which MLMIS provides one possible basic framework, would facilitate evaluation of the new development's environmental impact.

Conclusion

The hypothetical plant location and the watershed studies both show the need for comparable resource information. There is a large amount of data already collected by different agencies. If more of this data were integrated, questions such as the ones in these examples could be better answered. In these examples the data system itself does not make decisions. It only aids decision-makers, giving a more complete basis from which to make decisions or pointing out places where problems are most likely to occur in given situations.

Using MLMIS, potential locations and environmental impacts of many types of economic activities or public expenditures can be assessed for a given area or region. Future economic and population growth is likely to occur primarily in 14 urban clusters throughout Minnesota.[5] Thus, regional (or cluster) case studies can be carried out to help identify the optimum locations for private and public expenditures on facilities such as retail centers, hospitals or medical clinics, junior colleges and state colleges, highways and state recreation areas.

[5] Borchert, J.R. and Carroll, D.D., *Minnesota Settlement and Land Use, 1985,* University of Minnesota, August, 1971.

In order to use this type of decision-making technique, managers or administrators must define concise goals and objectives. The best example in Minnesota of such a statement of goals probably is the recently published guidelines for state outdoor recreation.[6] They exemplify the kinds of goal statements needed if public data banks are to be used effectively in making management decisions.

[6] Department of Natural Resources, Bureau of Planning, and State Planning Agency, Environmental Planning Section, *Minnesota Resource Potentials in State Outdoor Recreation,* Project 80, Staff Report No. 1, July, 1971.

Chapter VI

CONCLUSIONS AND RECOMMENDATIONS

- COORDINATED UPDATING OF PUBLIC RECORDS, USING STANDARDIZED DATA, SHOULD CONTINUE

This report illustrates how the data filed in many public agencies can be integrated and successfully used. It provides a strong case for continuing and intensifying efforts by federal, state and local government officials to standardize data and to coordinate the updating of public records. The next step would be to make it possible for the various branches of government and for researchers to have easy access to such a storehouse of public information.

A logical beginning would be for all public agencies to adopt built-in data updating procedures and to expand the basic classes of information used in this report: land use by 40-acre parcel, public land ownership, water information and local government fiscal information.

- DATA-COLLECTION BY ALL UNITS OF STATE GOVERNMENT SHOULD BE STANDARDIZED

No state system is possible unless the various agencies standardize their data. This means that codes for similar variables now described differently must be put in a standardized format common to all the agencies.

Example: Ownership of a wildlife area owned and managed by the Department of Natural Resources' Game and Fish Division should be coded the same way in that division's files as is the same information in the State Planning Agency and Department of Administration files.

- VARIABLES SHOULD BE DESCRIBED OBJECTIVELY, NOT SUBJECTIVELY, IN ORDER TO ASSURE UNIFORMITY

Describing variables such as a swimming beach in subjective terms such as "good" or "fair" is unwise because these descriptions have different meanings to different people — both resource-managers and resource-users — and the meanings change over time. Unless variables are described objectively, a gentle land slope defined on one agency's soils map and another's forest map may not always mean, for example, a slope of between 5 and 15 percent. A "large" Norway pine might mean a different size to a landscape architect, a park planner and a forester. To a child, a good beach probably would be one with sandy soil and a gentle slope, but to a strong, adult swimmer, this could mean a steep dropoff and rocks from which to dive. When specific variables such as the soil type and percent of slope are entered in a data bank in an objective form, the resource manager can evaluate the resource for a wide variety of management needs.

- A STANDARDIZED SYSTEM OF LOCATIONAL INFORMATION IS NEEDED

Variables are located and described in different ways. MLMIS as it now stands is based on unit area information — 40-acre tracts, one-fourth mile on a side.

The forty is an attractive unit to build from initially because most government records that relate to the land can be

measured at that level and a large part of the Minnesota transportation and settlement pattern has developed within the 40-acre grid. The 40-acre parcel can be subdivided into 10-acre or 2.5-acre cells for more unit accuracy.

However, a system should be capable of handling point and line data and relating to future national and universal data systems as well as other types of systems within the state. Latitude and longitude data is being incorporated into MLMIS to allow the entry and manipulation of point data and to permit the data conversion to other measurement systems.

- LAND-USE COMPILATION SHOULD BE UPDATED AT LEAST ONCE EVERY DECADE

A land-use map like the Region 1 map in this report has been published by MLMIS for the entire state. It is the most detailed land-use map ever made for an entire state. It is a census of the land — taken, like the census of population, at a particular point in time. It is crucial to update this land-use information at regular intervals. Minnesota should update its land-use information at least once every decade, concurrent with the taking of the federal census, so that the state has a census of its land as well as of its population. Without this type of information, it will be difficult for the state to make rational decisions about how its land should be managed.

- PHOTO-INTERPRETATION TECHNIQUES AND EXISTING DATA SYSTEMS SHOULD BE EMPLOYED TO KEEP LAND-USE INFORMATION CURRENT

One method of updating land use is aerial photography of the state at regular intervals. Photo interpreters then can interpret land use from the photographs (a replication of this study). However, this amounts to a complete restudy. An alternate method of updating land use and expanding the range of classes is being examined. The technique being considered would use existing state data systems. For instance, land devoted to manufacturing could be identified by use of the Directory of Manufacturers, if that directory were coded according to the "forty" on which companies are located.[1] Recreational land can be identified from a resort inventory[2] and the Department of Natural Resources' recreation inventory;[3] and urban uses from the records of county assessors. All of these are already fully or partly computerized systems. Other systems could be used for additional data on the location of such features as lakeshore homes, farm homes, business and building permits. A surrogate of land use could be determined by examining each of these systems. The major drawback of some of these systems is the lack of accurate and compatible location codes. Street addresses are insufficient; location to the forty, or another geographic system, would be far more useful.

- MINNESOTA SHOULD BE ALERT TO THE POSSIBILITIES OF NEW TECHNOLOGY IN UPDATING ITS LAND USE INFORMATION

Investigation should be made to determine if the Earth Resources Observation System (EROS) program of the Department of the Interior and the National Aeronautics and Space Administration (NASA) can be used in updating Minnesota's land use survey.

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[1] This listing of Minnesota-made products and their producers is prepared by the Research Division of the Minnesota Department of Economic Development. Classification has been done by location (city or town) and by product (Standard Industrial Classification — SIC).

[2] **Minnesota Lodging Industry Directory/Reservation System** This directory of all motels, hotels, resorts, and campgrounds in the state of Minnesota was collected by the Department of Agricultural and Applied Economics at the University of Minnesota for the 1971 Minnesota State Legislature. By using questionnaires and personal interviews, information including lodging facilities, location to the township and nearest town, rates, recreation activities, food and entertainment, and numerous other factors was collected. This census is presently maintained by the Minnesota Analysis and Planning System (MAPS) at the University of Minnesota.

[3] The Minnesota Recreation Inventory locates by forty all public and private recreational facilities in the state. Facilities inventoried ranged from State Parks to private campgrounds to golf courses.

- STATE LAND-OWNERSHIP RECORDS SHOULD BE CENTRALIZED AND PUT IN A FORM THAT MAKES ANALYSIS OF THE INFORMATION POSSIBLE

"Management responsibility of Minnesota's approximately 5.3 million acres of state-owned land is allotted among several state agencies.[4] Although each might have an accurate picture of its own land, there is at present no central information collection or distribution point accessible to all state agencies."[5]

This fragmentation has at least two negative results. First, Minnesota lacks a comprehensive picture of the land it holds — an overview necessary to make management decisions. Second, much digging through scattered records of diverse characteristics is now required to gain a complete picture of land ownership — an inefficient, expensive exercise.

- MINNESOTA SHOULD ISSUE PRESCRIBED PRACTICES FOR REPORTING ON PUBLIC LAND TO ASSURE THAT INFORMATION IS COLLECTED AND STORED IN A STANDARD WAY

Records on types of state-owned land (highways, military affairs, corrections, welfare, University of Minnesota, aeronautics, state colleges, junior colleges, etc.) are not collected in any standard manner. The State Planning Agency and the Department of Administration Information Systems Division are standardizing ownership codes in these areas, but *there is no prescribed reporting practice.*

A computerized inventory of the Department of Natural Resources land, which represents a large share of Minnesota's state-owned land, does exist in the Division of Lands and Forestry, Department of Natural Resources.

[4] The 5.3 million acres does not include the approximately 3.8 million acres of tax forfeit land held in trust by the state for the counties.

[5] Forsyth, James and Michael Hambrock, unpublished report, *State Land Inventory Pilot Study,* Minnesota State Planning Agency, 1969, page 3.

- MINNESOTA SHOULD CONDUCT AND PUBLISH PERIODIC INVENTORIES OF ITS LAND

Although Minnesota now regularly and routinely inventories its buildings and supplies, the state has no similar procedure regarding a much more valuable asset — its land. The state should develop a comprehensive state land-ownership reporting system that would make it mandatory for all state agencies to report any land purchases or sales on an easily computerized, standard form. Such a system would make possible periodic inventories of state land. Although an inventory of this type is required by law, one never has been conducted.[6] This inventory should be published; it should contain information such as agency ownership, acreage, value and type of management (i.e., the reason the land is in public ownership). Within the framework provided by MLMIS, a regular reporting system would make it possible to end duplicative, fragmented or uncoordinated public land purchases.

- A COOPERATIVE PROGRAM TO EXCHANGE LAND OWNERSHIP INFORMATION BETWEEN THE STATE AND COUNTIES, AND THE STATE AND FEDERAL GOVERNMENT, SHOULD BE INSTITUTED

Information on county land ownership in Minnesota is being collected in a cooperative program between the counties and the Department of Natural Resources.[7] A cooperative, periodic exchange of land-ownership records between counties

[6] Minnesota Statutes, 16.02, Subd. 7, Powers, Duties, Department of Administration: "To provide for the periodical inspection and appraisal of all state property, real and personal, and for keeping current and perpetual inventories thereof, and to require all departments and agencies to make reports of the real and personal property in their custody at such intervals and in such form as he may deem necessary."

[7] Land Use Classification Study, Minnesota Department of Natural Resources, Division of Lands and Forestry.

and the state would benefit planning and management efforts at both levels of government.

The other major public landowner in Minnesota, the federal government, holds most of its property in large blocks. Generally, its ownership records are well-organized. Federal agencies are cooperative in sharing data on the land they own — its quantity and location. It is our hope they would do this on a continuing basis as direct input to the state's computer system.

- MUNICIPALLY-OWNED LAND IN MINNESOTA SHOULD BE INVENTORIED

A statewide inventory of municipally-owned land has never been attempted in Minnesota. Such an inventory should be accomplished, to complete the record of land in Minnesota owned by the subdivisions of state government.

- A COMPREHENSIVE INFORMATION SYSTEM SHOULD BE CREATED ON MINNESOTA'S WATER RESOURCES BY COMBINING VARIOUS WATER RECORDS NOW MAINTAINED SEPARATELY AND BY ADDING ADDITIONAL INFORMATION NOT YET COLLECTED

Data is now spread among various state agencies, principally the Department of Natural Resources, Pollution Control Agency and the Department of Health. Regulatory and management programs of these agencies require access to other agency files. For example, the Pollution Control Agency is charged with classifying streams and regulating pollution. To do this the agency needs information on stream flows, much of which is kept by the Division of Waters, Soils and Minerals, DNR. They can also use information on surrounding land use from MLMIS, population characteristics from the U.S. Census, land value from county assessors, and agricultural statistics from the Crop and Livestock Reporting Service.

The Minnesota Department of Health analyzes about 5,000 well samples each year, but does not geographically locate the wells from which the samples were taken. Therefore, the distribution of wells and the quality of the water cannot be mapped or compared. Both measurements could be extremely useful to the Department of Health and the Pollution Control Agency. The examples illustrate the need for integration of the state's various water-related records in a comprehensive water information system. This system should include information in two general categories:

1. Location of water resources, and
2. Quantity and quality of the water.

- STANDARD IDENTIFIERS (INDEXES OR NUMBERING SYSTEMS) SHOULD BE CREATED FOR ALL LAKES, STREAMS AND OTHER WATER SOURCES IN MINNESOTA

The location of each lake, stream and underground water source should be identified under a common definition, with a unique description for each that will be used by all agencies.

- LAKE INFORMATION SHOULD BE COMBINED IN A CENTRAL FILE AVAILABLE FOR ALL STATE AGENCIES TO USE

The Minnesota Pollution Control Agency (PCA), the Department of Natural Resources' Division of Waters, Soils and Minerals and its Division of Game and Fish all are classifying Minnesota's lakes and streams. A central data file would eliminate duplication and overlapping of effort, and it would make the information collected by each agency readily available to the others. A good lake-numbering system already exists in DNR's Division of Waters, Soils and Minerals. This is an adequate base for storing lake information. Classifications used by each agency must be made compatible if they are to be used in a single system. Does the PCA, for example, classify a lake for appropriate pollution control when DNR labels it as a natural environment (high protection) lake?

- SIMILARLY, A SINGLE STREAM-INFORMATION SYSTEM SHOULD BE CREATED AND AVAILABLE FOR ALL STATE USERS. MINNESOTA SHOULD TAKE ADVANTAGE OF A FEDERAL PROJECT TO ACCOMPLISH THIS

Minnesota has an opportunity to obtain the basic stream-information system that it needs almost entirely without cost to the state. The U.S. Environmental Protection Agency (EPA) is conducting a project under which each Minnesota water course is being given a unique description and located accurately. It appears that the EPA system will provide an adequate data base to catalogue state information on rivers.

When this system is completed it will be possible, for example, to know that a water-monitoring station at a sewage plant outflow is located at a particular point on a river, and to know what is located upstream and downstream from that point. Upstream sampling can be used to determine whether water quality changes at the outfall. Downstream information can be used to assess the impact of any water quality change.

The system will be completed by October, 1972. States will be able to link to the federal system by remote terminal or by obtaining the EPA tapes; both approaches are being considered.

- GROUND WATER SOURCES SHOULD BE INVENTORIED IN A COORDINATED MANNER

Minnesota's underground water resources are poorly mapped. The principal source of underground water data, well-log information, is reported poorly throughout Minnesota. A 1971 law gives the State Health Department authority to license well-drillers, who supply well-log information. One licensing requirement should be that well-logs are reported in a form compatible with a computerized well-log information system developed by the U.S. Geological Survey. This system is maintained by the Minnesota Geological Survey.

- ALL AVAILABLE DATA ON THE QUANTITY AND QUALITY OF MINNESOTA WATERS – LAKES, RIVERS AND UNDERGROUND SUPPLIES – SHOULD BE SHARED

For planning and policy-making, state agencies and other government units need a wide variety of quantitative and qualitative information – the depth, area chemical content and water-level fluctuation of lakes; the volume and variability of river flows. Easy access to such information by agencies other than the collecting agency would make for more efficient, economical operation. DNR's Division of Game and Fish, for example, collects and uses data on lake depth, area, chemical content and volume. In addition to other state agencies, such as the Department of Health, various federal agencies including the Geological Survey, Corps of Engineers and Forest Service also collect this type of information. It is needed by DNR's Division of Waters, Soils and Minerals for use in its shoreland and floodplain zoning programs. The variability of water flow in rivers is especially important to the floodplain zoning program. All of this information is also needed by Division of Waters, Soils and Minerals in determining whether to grant permits for the appropriation of surface water. This program will take on added importance as increased amounts of water are used for supplemental irrigation and industrial and residential purposes.

APPENDIX

APPENDIX A: LOCATION INFORMATION

County Number

Counties are arranged in alphabetical order and numbered consecutively 1 through 87.

Township and Range Number

Each township in the state is identified by its township and range number according to the U.S. Land Survey System. East and West identifiers refer to the 4th principal meridian: "1" for ranges east, "2" for ranges west.

Section Number

Each section or square mile within a township is assigned a unique number from one through thirty-six.

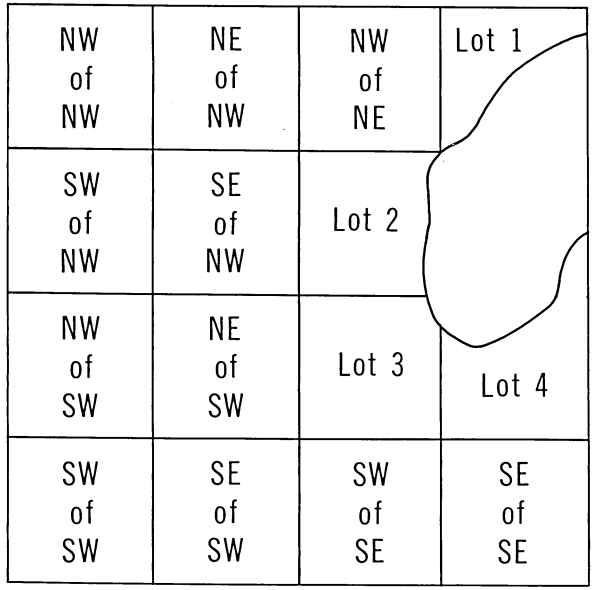
Geographical Unit — Forty or Government Lot

Each of the sixteen 40-acre parcels within a section is assigned a unique number. In coding the legal description of each forty, MLMIS substitutes numbers for the letters used in the legal description. Figure A shows the legal description of a section with meandered water. Figure B shows the same section as it is coded in the MLMIS system.

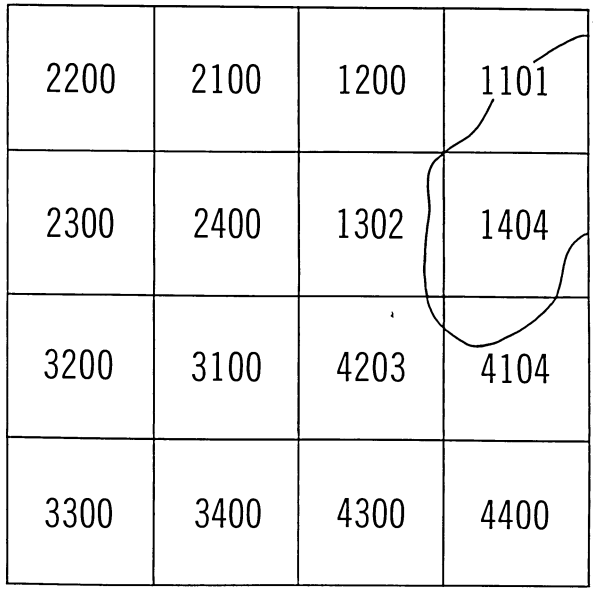
Government Lot

Government lot numbers were assigned in the original land survey to parcels that were not 40.0 acres. The fact that a parcel is a government lot does not indicate that the parcel is owned by the government, but only that it has been surveyed to determine its exact size. The numbering of these lots repeats itself for each section, starting with government lot number one and continuing until all lots have been numbered.

A. LEGAL DESCRIPTION OF SECTION



B. MLMIS NUMERICAL DESCRIPTION OF SECTION



Government lots are commonly found along the northern and western tiers of parcels in each township and along meandered rivers and lakes. Parcels along the northern and western edge of townships are generally not exactly 40.0 acres due to the convergence of longitudinal lines. Lakes and rivers that were surveyed in the original land survey are adjoined by government lots and are referred to as meandered lakes and rivers. A meandered river or lake, in this case, is not defined by the twisting, turning configuration normally associated with the term "meandered." Meandered refers only to the fact that the river or lake is adjoined by surveyed government lots.

Latitude and Longitude

Latitude and longitude were determined for the central point of each minor civil division. The calculation of latitude and longitude was interpolated to the nearest second from Minnesota Highway Department county highway maps. Latitude and longitude were calculated to make MLMIS data comparable to other geographic coding systems.

Minor Civil Division Number

The minor civil division number is derived from a national numbering system used by the Bureau of the Census to identify municipal and township governmental units. The identifying number is assigned alphabetically to the minor civil divisions within a county.

APPENDIX B: WATER ORIENTATION

Wherever a forty adjoined a lake, stream, or ditch it was given a water orientation code. Water orientation codes that were used in MLMIS:

(0) or Blank — No water touching forty.
(1) Forty is on an island.
(2) Forty is on a meandered lake.
(4) Forty is on a non-meandered lake.
(7) Forty is on a meandered river.
(8) Forty is on a non-meandered river that flows year round.
(9) Forty is on a drainage ditch or non-meandered river that is seasonally dry.

Water orientation information was gathered from two different sources. Aerial photos were used to determine the water orientation for all lakes with an area greater than 10 acres. Orientation for all other bodies of water was determined from Minnesota Highway Department county highway maps. The county highway map distinguishes year-round and seasonally dry water courses.

APPENDIX C: LAND USE

Land use as determined from aerial photographs was classified into one of nine categories. The dominant land use was coded for each forty.

1. Forested
2. Cultivated
3. Water
4. Marsh
5. Urban Residential
6. Extractive
7. Pasture and Open
8. Urban Non-residential or Mixed Residential
9. Transportation

A detailed description of the interpretation procedure of land use determination follows.

Aerial Photographic Interpretation Procedure

1. Equipment and Material

Aerial photographs — Aerial photography was purchased from Mark Hurd Aerial Surveys Inc.

Camera	Wild RC-8
Photo scale	1:90,000 (1" = 7500')
Flight height	45,000' AMG
Focal length	152.22mm (6 inches)
Dates flown	Spring, 1968 and 1969
Type of film	Black and white, Panchromatic

Stereoscope — Old Delft
(variable power, mirror type)

Mylar grid — (sections and forties)

Maps — Minnesota Highway Department county highway maps (Scale 1:63,360)

2. Aerial Photographs

Aerial Photographs financed by the Minnesota Highway Department, the Minnesota State Planning Agency and the Upper Great Lakes Regional Commission were used to determine land use for each forty. Contact prints and photo indices were furnished to the three participating agencies, and one complete set of mylar positive transparencies (Photo-maps), coincident with the USGS 7½ minute quadrangle topographic sheets, was delivered to the Minnesota Highway Department. The 1,708 transparencies (Scale, 1:24,000) provide coverage of the state and fill the gaps within Geological Survey coverage at this scale.

Some of the uses of the photos and transparencies include:

A. The Minnesota Highway Department, updating county highway maps.
B. The Department of Natural Resources:
   1) Bureau of Planning, for studying the St. Croix Wild River, and for locating recreation areas.
   2) Division of Game and Fish, for inventory work in wetlands and for field reconnaissance in watershed investigations.
   3) Division of Waters, Soils and Minerals, the transparencies of the 7½ minute equivalents in the administration of shoreland and floodplain zoning programs.
C. The Department of Economic Development is studying the use of photo enlargements for planning purposes.
D. The Soil Science Department, University of Minnesota, has used the photos in soil mapping programs. The photos are used for: delineating topographic areas; locating roads and trails; determining soil group boundaries; delineating mines, dumps and cultural features that would not have been found on prior leaf-on photos.

E. The United States Geological Survey uses the 7½ minute quadrangle equivalents (photo maps), diapositives, and contact prings for interim revision of its quadrangle maps. The photos are also used for USGS' new, 7½ minute orthophoto maps.

3. Interpretation Procedure

Aerial photographs and recording maps were prepared for interpretation by outlining townships in red. This facilitated grid placement and reduced recording errors.

The photos were interpreted by a three-man team; two interpreters and a map recorder. Double interpretation improved accuracy. The basic unit of interpretation was the township, within which section lines were followed. Each regular section was divided into sixteen forty-acre parcels with the aid of mylar grids. Photos have overlapping coverage, producing a three dimensional effect when viewed with a stereoscope. Field checking was done to insure ground truth and interpretation accuracy in ambiguous areas.

4. Definitions and Explanations of Interpretation

A. Forty – the basic unit utilized in this study is the 40-acre parcel (1/16 of a section). Field lines and timber cutting boundaries were used to determine forty location wherever possible; in addition a transparent grid was used for greater accuracy. It was assumed that forties cover all surface area, including water bodies.

B. In the water and marsh classes, the concept of permanency was incorporated into the system to distinguish normal surface configurations from flooded situations.

C. Any forty adjoining a water body covering 10 acres or more was designated as water oriented. The interpreters circled the land-use code on the recording maps for every water oriented forty.

Criteria for Land Use Identification from Aerial Photographs

A. **Forested** – A forty in which the land use consists of deciduous or coniferous trees. To be considered forested, a forty must contain a scattering of trees with at least 10 percent crown cover.
Problems:
1) Some difficulty was experienced distinguishing short trees and lowland brush.
2) In some areas tree canopies descend gradually into swamps so that a definite boundary between the two was difficult to establish.

B. **Cultivated** – A forty in which the dominant land use consists of land which appears recently tilled or harvested mechanically.
Problems:
1) Frequently it was difficult to distinguish cultivated land and abandoned fields or open land.
2) Farmsteads were classified as "cultivated" land when this inclusion made cultivated the dominant use.

C. **Water** – A forty in which the dominant land use consists of permanent open water.
Problems:
1) Some trouble was experienced in determining land use in flooded areas.
2) In a few instances it was difficult to determine shoreline when ice was present.

D. **Marsh** – A forty in which the dominant land use consists of non-forested, vegetated areas which are permanently wet.
Examples:
Marshes, meadows, bogs, sloughs
Problems:
1) There was some difficulty establishing the edges of wet areas where slope is gentle.

2) Flooding caused some difficulty in determining wet areas.
3) See Problem 2 under Forested.

E. **Urban Residential** – A forty containing five or more residential buildings and no commercial buildings.
Examples:
Seasonal and permanent lakeshore homes, resorts, mobile homes, and other residential dwellings
Problems:
1) Because of the size of structures, it was sometimes difficult to distinguish residential buildings and non-residential buildings such as churches, town halls, filling stations, apartment buildings, etc.
2) Occasionally, residential structures along lakeshore were not distinguishable because they are hidden by coniferous tree canopies.

F. **Extractive** – A forty in which the dominant land use consists of the extraction of minerals, including ancillary facilities.
Examples:
Mines, tailings, gravel pits, quarries, crusheries, storage facilities

G. **Pasture and Open** – A forty in which the dominant land use consists of pasture land or land not used for any other identifiable purpose.
Examples:
Grazing land, transitional upland brush, abandoned farmland, meadows, beaches, rock outcrops.
Problems:
1) There was difficulty in areas of transition between open and wet and forest areas (see preceding explanations of these classes).
2) See Problem 1 under Cultivated.

H. **Urban Non-Residential or Mixed Residential** – A forty containing at least one commercial, industrial, or institutional development.
Examples:
Schools, factories, hospitals, nurseries, cemeteries, golf courses, gun clubs, athletic fields, organized recreational facilities, business districts, churches, filling stations, government buildings, warehouses, storage tanks, grain elevators, military installations, sewage disposal facilities, fish rearing areas, radio and television stations, drive-in theaters, state and county garages, prisons, motels, nursing homes and junk yards.
Problems:
1) There was some difficulty in differentiating small structures in this class and residential structures (see Residential definition).

I. **Transportation** – A forty in which the dominant land use consists of facilities for the conveyance of people and/or materials.
Examples:
Airports, railroad yards, highway interchanges, rights-of-way.

6. Spatial Distribution of Interpreting Time

The average interpretation time for northern Minnesota was 26 minutes per township. This does not include field checking, report writing or preparation of photos and maps.

Interpretation time ranged from 5 minutes to 110 minutes. These time variances were grouped into 5 classes from very fast to very slow (Table A). The range of interpretation time is primarily accounted for by the physical and cultural characteristics of each township.

Five categories of physical characteristics were isolated by the interpreters as problems most affecting interpretation time: beach ridges, open-cultivated decisions, marsh-open decisions, forest-swamp decisions, and forest-open decisions. In addition to these problems, two cultural characteristics were found to affect interpretation time. In larger urban centers and in the extractive areas of the Iron Range, interpretation time tended to be greater.

Table A — Distribution of Townships By Time Class and Interpretation Problems

Interpretation Time	Percent of Townships By Time Class	Average Number of Physical-Cultural Problems Affecting Interpretation Time
Very Fast (5-10 Minutes)	12	0.8
Fast (11-20 Minutes)	26	1.3
Medium (21-35 Minutes)	30	1.6
Slow (36-60 Minutes)	27	2.1
Very Slow (61 + Minutes)	5	2.0
TOTAL	100%	

This time and problem distribution was determined from a systematic sample of 1/3 of the townships in northern Minnesota.

The distribution of townships by interpretation speed shows that 38 percent took less than 20 minutes to interpret, and all but 5 percent required less than one hour. In general, the more interpretation problems in a township, the more time involved in interpretation.

Table B shows the occurrence of calling problems within each speed class.

Table B — Occurrence of Interpretation Problems within each Time Class

	Very Fast	Fast	Medium	Slow	Very Slow	Total
Beach Ridge	3%	7%	5%	5%	12%	4%
Open-Cultivated	20	46	67	77	82	37%
Swamp-Open	13	32	40	63	53	25%
Forest-Swamp	37	30	33	32	18	22%
Forest-Open	8	16	17	22	47	12%
						100%

Three kinds of decisions were major determinants of calling time: Open-cultivated, swamp-open and forest-open decisions. In the very slow calling time, 82 percent of the townships had open-cultivated decisions, and about half had forest-open or swamp-open decisions. These figures imply that areas of recent farm abandonment and areas with low value farm land (grazing) or with swamp present the greater interpretation difficulty.

Figure C shows the spatial distribution of interpretation time for northern Minnesota. Interpretation time was slow in the farmed moraine region, in areas with lakeshore settlement, in the eastern agricultural fringes of the Red River Valley, and in the Iron Range. Interpretation time was medium in the forested areas with lakeshore development, fast in forested areas with undeveloped lakes, and very fast in totally forested or totally cultivated areas.

Figure C
DISTRIBUTION OF INTERPRETATION TIME

APPENDIX D: PUBLIC OWNERSHIP

FEDERAL LAND OWNERSHIP

U. S. Forest Service

Code

01 **Boundary Waters Canoe Area (BWCA)** – Ownership was recorded from Forest Service ownership maps. The BWCA is in the counties of Cook, Lake, and St. Louis. All forties owned by the Forest Service within the BWCA are coded "01".

02 **National Forests** – All forties owned by the Forest Service outside of the BWCA are also coded from Forest Service ownership maps. Such forties are found in the counties of:

Cook, Lake, St. Louis – Superior National Forest
Beltrami, Cass, Itasca – Chippewa National Forest

All such parcels are coded "02".

U. S. Bureau of Sport Fisheries and Wildlife

Code

04 **National Wildlife Refuges** – Parcels within Wildlife Refuges which are owned in fee title by the Bureau are coded "04".

National Wildlife Refuges	County
Agassiz	Marshall
Rice Lake	Aitkin
Sherburne	Sherburne
Tamarac	Becker, Mille Lacs
Upper Mississippi	Houston, Wabasha, Winona

Code

14 Parcels within Wildlife Refuges where only flowage rights are claimed are coded "14".

15 The Bureau of Sport Fisheries and Wildlife leases land to the State of Minnesota within the Beltrami Island Settler Relocation Project for waterfowl production. Part of Beltrami Island State Forest (Executive Order 9091), this land is located in Roseau, Lake of the Woods and Beltrami counties.

05 & 06 **Waterfowl Production Areas** — Parcels within Waterfowl Production Areas owned in fee title by the Bureau are coded "05". Parcels with easements alone purchased by the Bureau are coded "06". Waterfowl Production Areas are located in the counties of:

Becker	Grant	Ottertail	Swift
Big Stone	Jackson	Polk	Traverse
Clay	Kandiyohi	Pope	Wilkin
Cottonwood	Lac Qui Parle	Stearns	Yellow Medicine
Douglas	Mahnomen	Stevens	

Data source for all Bureau records was Bureau of Sport Fisheries and Wildlife regional office at Fort Snelling, Minnesota.

Bureau of Indian Affairs

Code

11 All parcels designated "Tribal" land by the Bureau of Indian Affairs.

12 All parcels designated "Allotted" land by the Bureau of Indian Affairs.

13 All parcels designated "Government" land by the Bureau of Indian Affairs (administrative sites and Land Utilization Project land).

Reservation	County
Fond du Lac	Carlton, St. Louis
Grand Portage	Cook
Leech Lake	Beltrami, Cass, Crow Wing, Hubbard, Itasca
Mille Lacs	Aitkin, Crow Wing, Mille Lacs, Ottertail, Pine
Nett Lake (Vermillion)	Koochiching, St. Louis
Lower Sioux	Redwood
Upper Sioux	Yellow Medicine
Prairie Island	Goodhue
Prior Lake	Scott
Red Lake	Beltrami, Clearwater, Koochiching, Lake of the Woods, Marshall, Pennington, Red Lake, Roseau
White Earth	Becker, Clearwater, Mahnomen
Winnebago	Houston

Ownership records were provided by the Bureau of Indian Affairs office in Bemidji, Minnesota.

Bureau of Land Management (BLM)

Code

03 The BLM has conducted an extensive study of all its ownership in Minnesota. Copies of completed county reports are filed with the Department of Natural Resources, Division of Lands and Forestry. With the exception of holdings in Koochiching County, most of the BLM ownership consists of small islands. Those islands over 10 acres were recorded by MLMIS. Islands under 10 acres that were not government lots were not recorded. All government lots were recorded regardless of size.

The following counties have BLM ownership for which data was recorded:

Becker	Koochiching	Lake of the Woods
Clay	Ottertail	
Grant	Pope	

Parcels owned by the BLM were coded "03".

National Park Service

Code

07 Includes Pipestone National Monument and Grand Portage National Monument.

U.S. Army Corps of Engineers

Code

08 & 09 Corps of Engineers ownership was obtained from records prepared by the Corps realty office in the St. Paul Post Office. Corps of Engineers ownership is in the counties of:

Aitkin	Goodhue	Wabasha
Cass	Itasca	Winona
Crow Wing	Ottertail	

Forties owned in fee title by the Corps of Engineers are coded "08".

All parcels with easement rights purchased by the Corps are coded "09".

Other Federal Land

Code

10 This code was used for other federally owned lands.[1]

[1] The code 10 was used for military lands in and around Duluth. Detailed maps of federal military ownership in the Twin Cities area were not available, so this federal ownership is not included in the study. This omission amounts to about 4000 acres of federal land.

STATE LAND OWNERSHIP

The majority of state-owned land in Minnesota is incorporated into one of two computerized systems. The Division of Lands and Forestry, Department of Natural Resources, has inventoried all lands administered by the Department of Natural Resources. In addition to DNR lands, this inventory included county tax forfeit lands. Miscellaneous state lands (military affairs, University of Minnesota, correctional institutions, etc.) have been inventoried by the State Planning Agency. The only major segment of state-owned land not incorporated into these systems is highway right-of-way. Information incorporated in these systems includes acreage, means of acquisition, managing agency and management area.[2]

Department of Natural Resources

Code

20 Lands and Forestry Within State Forests
21 Lands and Forestry Outside of State Forests
22 Waters, Soils and Minerals
30 Section of Game Lands
31 Section of Fish Lands
32 Law Enforcement (Public Access)
40 Parks and Recreation

Minnesota Department of Highways

Code

50 Roadside Parks
51 Other Land Adjacent to Lakes and Streams
52 Maintenance and Garage Sites
53 Gravel Pits
54 Other Highway Department

[2] See Department of Administration Land Ownership Coding Manual for detailed identification codes.

Other State Agencies

Code

60	Military Affairs
61	Agriculture
62	Corrections
63	Welfare
64	University of Minnesota
65	Aeronautics
66	State Colleges
67	Junior Colleges
68	Other

County Lands

Code

70	County Forest
71	Tax Forfeit Land Outside County Forests
72	County Parks and Recreation Areas
73	County Right-Of-Way
74	Other County Acquired

APPENDIX E: SECONDARY DATA SOURCES

Crop and Livestock Reporting Service

The Crop and Livestock Reporting Service is an agricultural data gathering agency jointly funded and staffed by the United States Department of Agriculture and the Minnesota Department of Agriculture. Its function is to provide farmers with current information on crop and livestock production and commodity prices and trends. This information is of use to farmers in planning future planting. The same information is also widely used by various agencies of government, by educational institutions, and by agricultural industries in determining production and marketing decisions and plant and retail facility location. Much of this data is collected in raw form at the minor civil division level. Data collected includes: [3]

Total land in farms
Corn for grain
Soybeans
Oats
Barley
Flax
All wheat farms
Spring wheat
Durum wheat
Winter wheat
Rye
Sunflowers
Potatoes
Peas
Sweet corn
Cabbage
Onions
Alfalfa
All other tame hay
Wild hay
Red clover seed
Timothy seed
Sweet clover seed
Alfalfa seed
No. of livestock farms
Hens and pullets
Ewes
Milk cows – 2 yrs. and older
Beef cows – 2 yrs. and older
All other cows
Grain fed steers and heifers
Spring sows farrowed
Fall sows farrowed
Hogs marketed for slaughter

[3] Data on some crops, sugar beets and potatoes for example, is collected from local processors at the county level rather than the minor civil division level.

U.S. Census

The Bureau of the Census is a federal statistical agency which collects, tabulates, and publishes a wide variety of statistical data about the people and the economy of the nation. This information is used by the government and the public in the development and evaluation of economic and social action programs.

The principal functions of the Bureau include: (1) decennial censuses of population and housing; (2) quinquennial censuses of agriculture, state and local governments, manufacturers, mineral industries, commercial fisheries, construction industries, and transportation; (3) current surveys which provide information on many of the subjects covered in the censuses at weekly, monthly, quarterly, annual, or other intervals; and (4) compilation of current statistics on U.S. foreign trade, including data on imports, exports, and shipping. In addition, the Bureau conducts special censuses at the request and expense of state and local government units; publishes estimates and projections of population; provides current data on population and housing characteristics, including consumer income and buying intentions; and issues current reports on manufacturing, retail and wholesale trade, selected services, construction, imports and exports, and state and local government finances and employment.

Census information is available in its most comprehensive form for population numbers and characteristics, and for socio-economic data such as employment, education, and income at the minor civil division level.

Rapid Analysis Fiscal Tool (RAFT)

RAFT is a project originally funded by the Ford Foundation and now being further developed with funds from the Minnesota State Department of Administration. When completed, RAFT will provide individuals, departments, and policy makers with a tool which will provide a better understanding of Minnesota's state and local tax and finance system and to estimate the impact of changes in that system.

RAFT is being developed at the University of Minnesota and is administered by the Center for Urban and Regional Affairs.

APPENDIX F: PRODUCTION OF THE LAND USE MAP

Preparation of the Land Use Data for Computer Use

A four-step process was used to prepare the land use data for computer use.

Step 1. A punch card with mark sense capabilities was prepared for each data cell. On each card, location codes consisting of county, township, range, section and 40-acre parcel location were prepunched.

Step 2. Land use for each parcel was entered on the card by a pencil.

Step 3. Automatic transferal of mark sense cards to magnetic tape was made via Motorola mark sense reader.

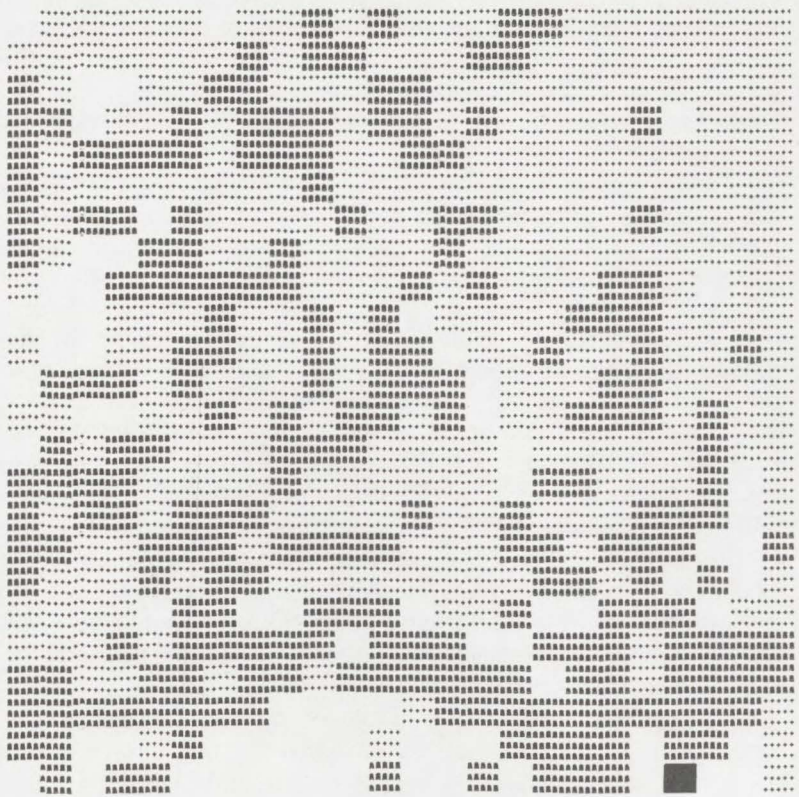
Step 4. Using the Minn-Map Program to find errors and Control Data Corporation's 7000 Modify/Scope system to correct the tapes, land use errors and information accuracy were checked and corrected.

Minn-Map Program

The land use map was produced by integrated computer and photographic methods. Minn-Map is the multi-purpose mapping program developed by the MLMIS project. It has been used for such varied purposes as error checking land use recording accuracy and producing printing plates for the nine-color land use map.

The photo-reduced township map (Figure D) is an example of an overlay used in the map making process. Minn-Map produces a township map 72 computer printer characters high and 120 characters wide. There are 576 data cells (forties) in a township. On the computer printout, each data cell is five characters wide by three high. This is the smallest set of characters that will produce a square cell on most computer printers.

Minn-Map Township (Red Overlay)



Uses of the Minn-Map Program

1. Printing of black and white or color map plates.
2. Printing in spatial form variables computerized on the MLMIS format such as: land use, public ownership, stream and lake locations, soils and slope classes.
3. Combinations of variables can be printed out, for example, forested land adjoining streams in state ownership.

Multicolor Mapping

In order to make the multi-color land use map, three maps of each township were printed by the computer. These printouts were in varying scales of gray. The maps represented the red, yellow and blue (the primary colors) overlays used in the printing process. The printouts were photographed through colored filters and then reduced to 1:500,000 scale to produce the final map.

STATE OF MINNESOTA LAND USE MAP

A color map depicting current land use in the State of Minnesota is available from the Bulletin Room, 90 Coffey Hall, University of Minnesota, St. Paul, Minnesota 55101. The cost of the map is $2.50 for over-the-counter sales at Coffey Hall or $3.50 postpaid. All Minnesota residents must add 4 percent sales tax. Checks should be made out to the "University of Minnesota."

STATE OF MINNESOTA LAND USE

DEVELOPMENT REGION 1

1969

Scale 1:500,000

1 inch equals approximately 8 miles

10 0 10 20 30 40 Miles

10 0 10 20 30 40 50 Kilometers

LEGEND

- State capital
- County seat
- City, town, or village
- Scheduled service airport
- County boundary
- Corporate boundary shown for towns over 5,000 population
- National park, National forest, National wildlife refuge, or Indian reservation
- Interstate highway
- U. S. highway
- State highway
- Other principal roads

POPULATION KEY

ST PAUL	more than 100,000
ROCHESTER	25,000 to 100,000
Hibbing	10,000 to 25,000
Marshall	5,000 to 10,000
Windom	less than 5,000

Population indicated by size of letters

- Forested
- Cultivated
- Pasture and Open
- Water
- Marsh
- Urban Residential
- Urban Non-residential or Mixed Residential
- Extractive
- Transportation

DEVELOPMENT REGIONS

EXPLANATION OF LAND USE CLASSES

FORESTED — A forty in which the dominant land use consists of trees. To be considered forested, a forty must contain a scattering of trees whose crowns cover at least 10 percent of the land area.

CULTIVATED — A forty in which the dominant use consists of land which has been recently tilled or harvested mechanically.

PASTURE AND OPEN — A forty of non-forested land not used for any identifiable purpose. Examples are grazing land or abandoned farm land.

WATER — A forty in which the dominant land use is open and permanent water.

MARSH — A forty in which the dominant land use consists of non-forested, shallow permanently wet, vegetated areas.

URBAN RESIDENTIAL — A forty containing five or more residential dwellings, and no commercial buildings.

URBAN NON-RESIDENTIAL OR MIXED RESIDENTIAL DEVELOPMENT — A forty containing at least one commercial, industrial, or institutional development and may or may not contain residential development.

EXTRACTIVE — A forty in which the dominant land use consists of the extraction of minerals, including ancillary facilities. Examples are mines, tailing piles, gravel pits.

TRANSPORTATION — A forty in which the dominant land use consists of facilities for the conveyance of people or materials.

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PRODUCTION ASSISTANCE — Department of Geography, University of Minnesota; Printing Department, University of Minnesota; Social Science Computer Center, University of Minnesota.

PHOTO SOURCES: Land use was interpreted from spring, 1969 aerial photography scale 1:90,000.

BASE MAP — United States Geological Survey, 1963.

Produced by Minnesota Land Management Information System Study, University of Minnesota, 1971, under contract with the Minnesota State Planning Agency

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